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USAF Testimony on Airpower Budget

•

Pan American Aim: More Latin Traffic



Beech 73 Jet Mentor





The Terrier... Navy Man's "Best Friend"

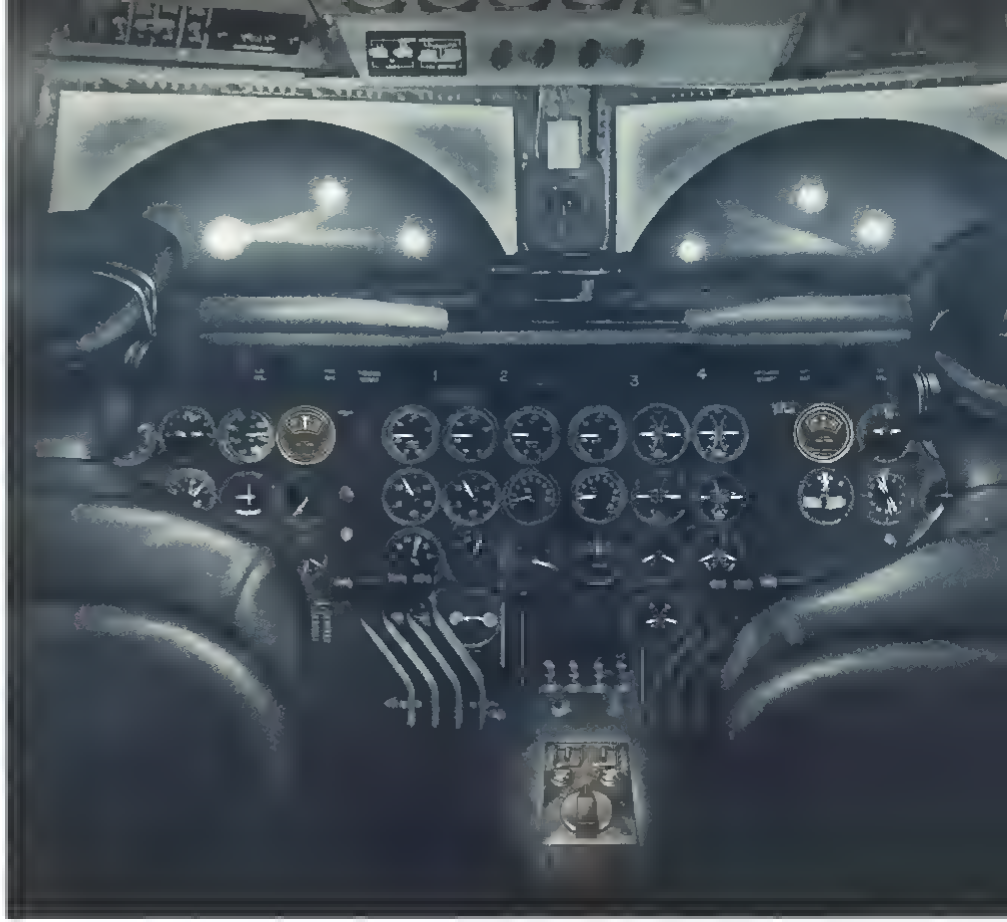
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AVIATION CALENDAR

May 13-23—Seventh All Women's International Air Race, Hamilton Ont. Canada to Havana, Cuba

May 14-17—Design Engineering Conference of American Society of Mechanical Engineers, Convention Hall, Philadelphia

May 16-18—Society for Experimental Stress Analysis spring meeting, William Penn Hotel, Pittsburgh, Pa.

May 17-19—New York State Society of Professional Engineers 30th Engineering Industries Exposition and annual convention, Statler Hotel, New York

May 18—Armed Forces Day Dinner, Sheraton Park Hotel, Wash., D. C.

May 19—Airspace Forum sponsored by National Pilots Association, Westchester County Airport, New York

May 21—Annual meeting of the Daniel Guggenheim Medal Board of Award, University Club, 1 W. 54 St., New York

May 24-26—Armed Forces Communications and Electronics Association, 10th national convention, Boston, Mass.

May 30-June 3—Eighth Annual Wright Memorial Glider Meet, sponsored by The Soaring Society of Dayton, Dayton

June 2—Seventh Annual Maintenance & Operations Meeting, Reading Aviation Service, Inc., Reading Municipal Airport, Reading, Pa.

June 3-8—Society of Automotive Engineers summer meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

June 4—National Fire Protection Association Seminar on Jet Speed with Fire Safety, Hotel Statler, Boston, Mass.

June 5-6—Radio Technical Commission for Aeronautics spring meeting with Boston sections of Institute of Radio Engineers and Institute of the Aeronautical Sciences, Hotel Statler, Boston, Mass.

June 11-15—Society of the Plastics Industry Seventh National Plastics Exposition, New Coliseum, New York, N. Y.

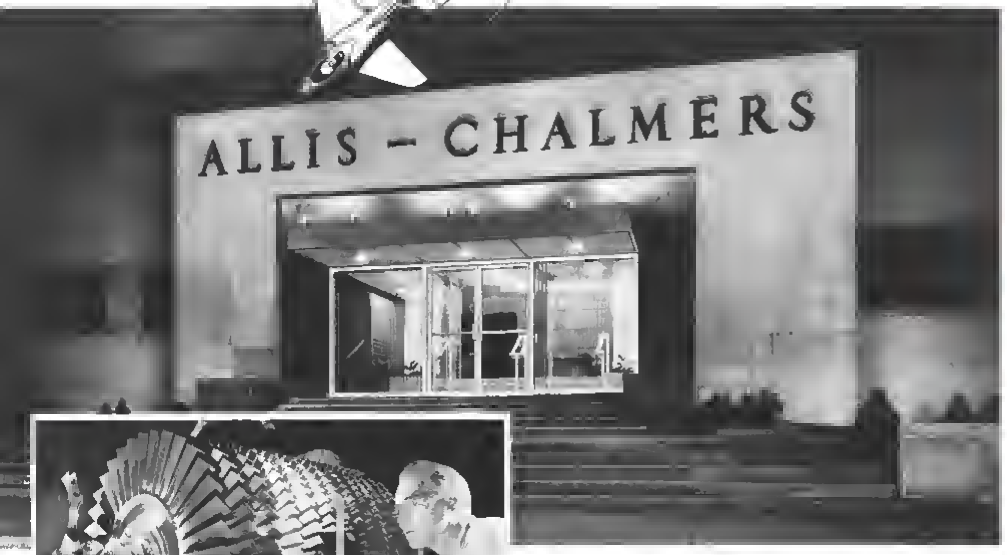
June 13—B. F. Goodrich Technical Forum, co-sponsored by Atlantic Aviation Corp. and Airwork Corp., Atlantic Aviation Hangar, Teterboro Airport, Teterboro

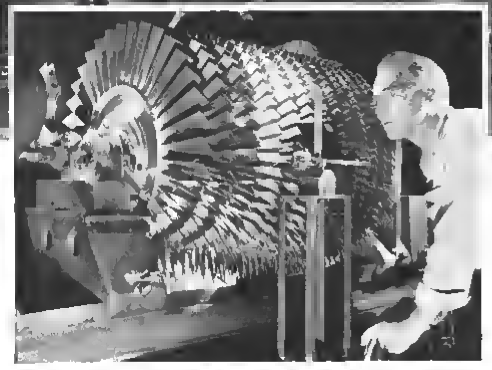
June 17-21—American Society of Mechanical Engineers, semi-annual meeting, Hotel Statler, Cleveland, Ohio

AVIATION WEEK • MAY 7, 1956
Vol. 64 No. 19

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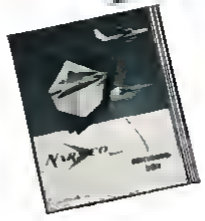
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An engineers notes on the HY-V/L* *pump*

the problem.

The reduction in the ambient pressure at high altitude causes the fuel in the tank and system lines to boil. The boiling creates vapor. The vapor locks the fuel supply and the engine fails.

Higher ceilings and faster rates of climb have accentuated this problem. The answer: a better fuel booster pump.

the requirements

for this pump are as follows:

1. Low current consumption, especially at full flow — because electrical power is at a premium.
2. Light weight, of course, and compactness.
3. Simplicity of design, easy to service, minimum number of close-tolerance parts.
4. It must handle contaminated fuels and different types of fuel.
5. It must recover instantly if it is stopped and restarted.

the solution:

Hydro-Aire's new HY-V/L pump meets all of these requirements. This pump can handle large quantities of fuel vapor — without a vapor separator — by compressing the vapor back into liquid form inside the pump. It handles boiling fuel with a minimum of disturbance — therefore creates less foaming than the conventional booster pump. It has excellent climb performance.

outstanding feature

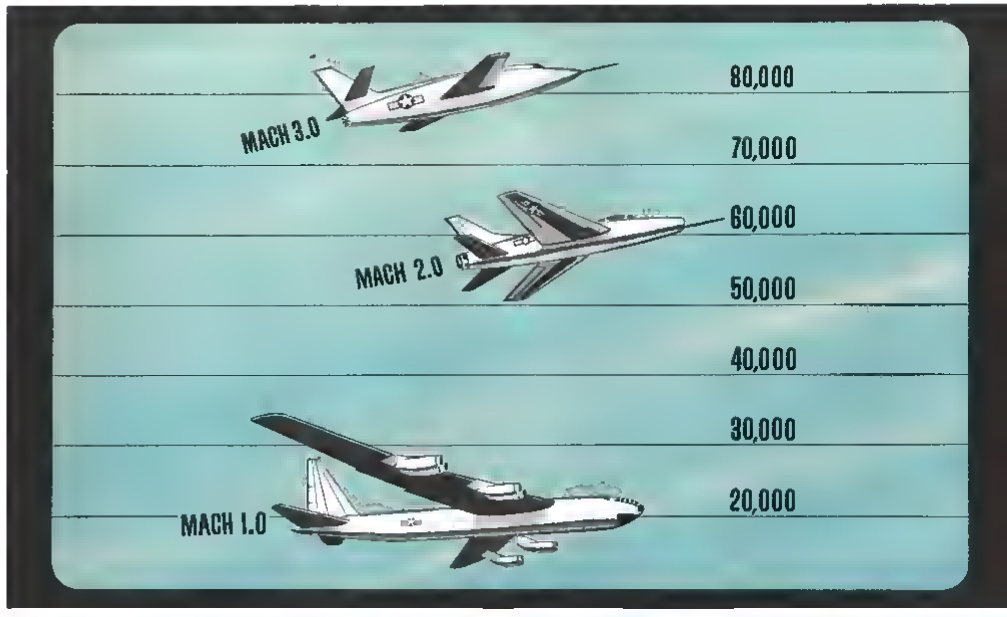
of the HY-V/L pump is the design of its impeller. Hydro-Aire engineers call it a "dynamically similar" impeller, a base impeller in which each dimension is multiplied by a constant scale factor to get a new diameter. Because of this feature, Hydro-Aire can supply you with a chart to predict the characteristics (weight, size, power requirements, etc.) of a pump to meet your specific needs.

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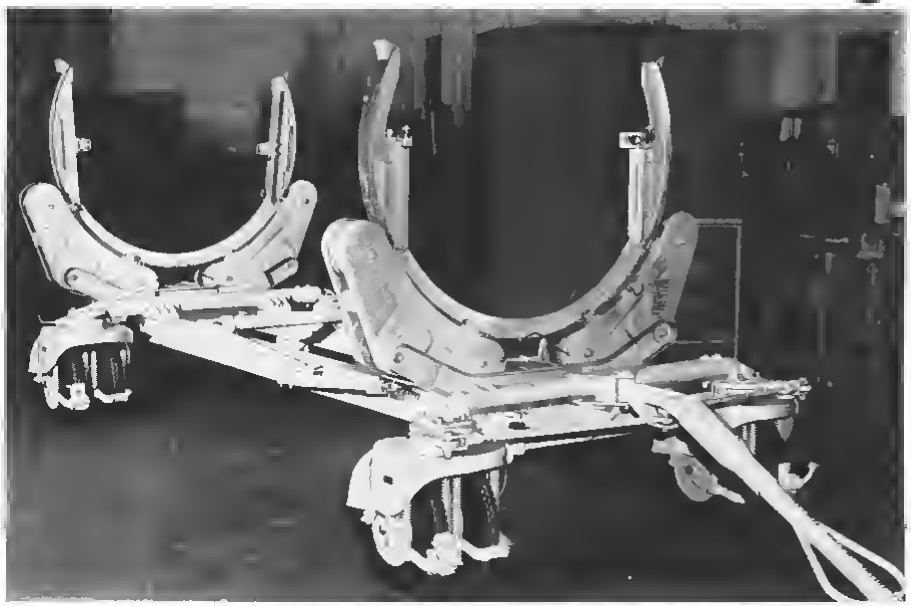
We believe we have the answers you have been looking for and would like to discuss them with you. ECLIPSE-PIONEER DIVISION, BENDIX AVIATION CORPORATION, TETERBORO, N.J.

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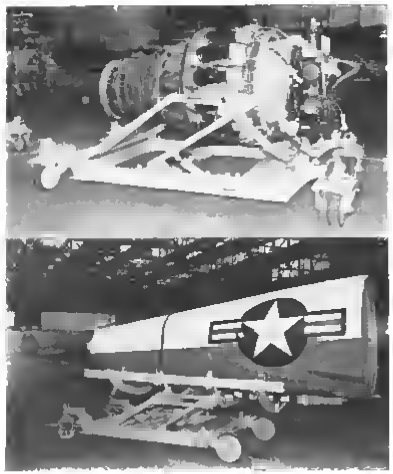
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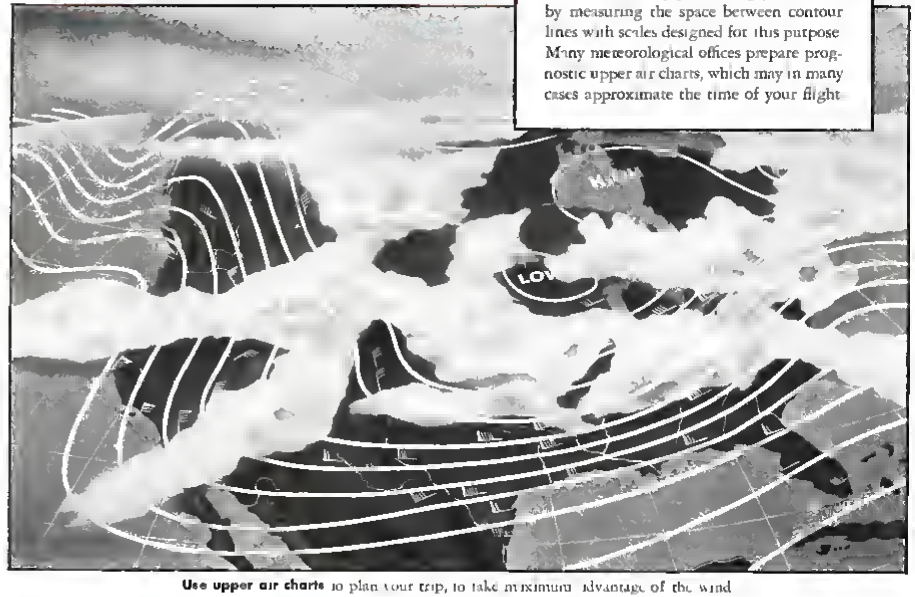
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The Role of Modern Test Facilities in the Design of Aircroft Geor Drives

by John Morris
Manager of Engineering, Western Gear Corporation

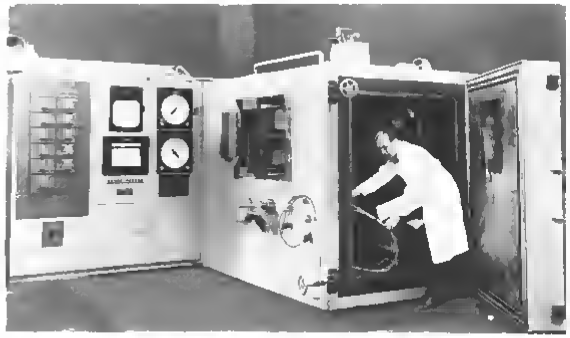
Modern aircraft, whether it be piloted or electronically guided, requires mechanical devices of utmost reliability No longer can the designer depend entirely upon experience but must have available extensive equipment capable of producing the environments and loading conditions which will check the newly designed parts to the conditions encountered on its assigned mission

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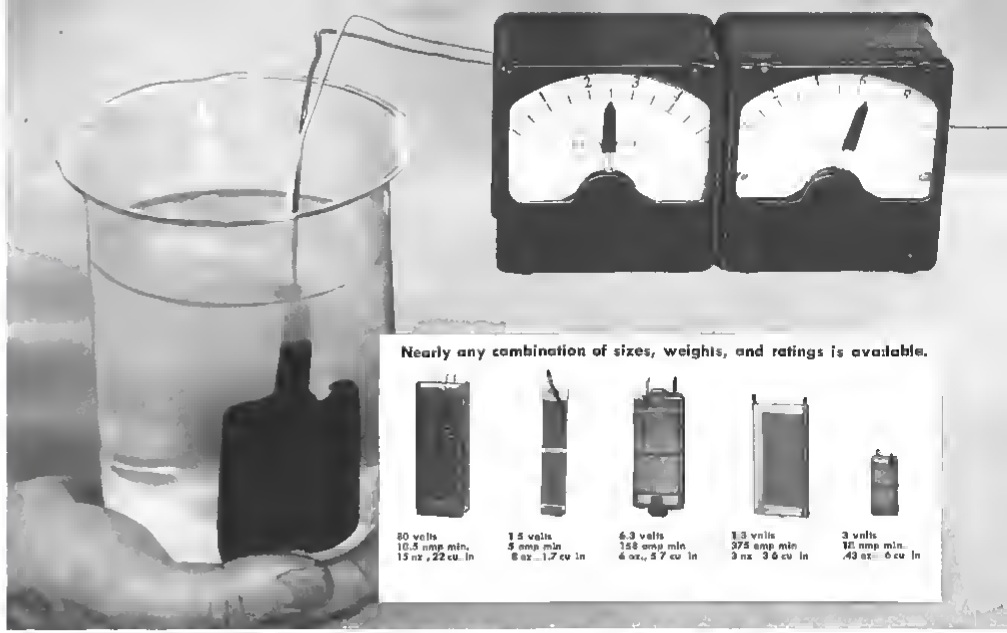
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MAY 7, 1956

AVIATION WEEK

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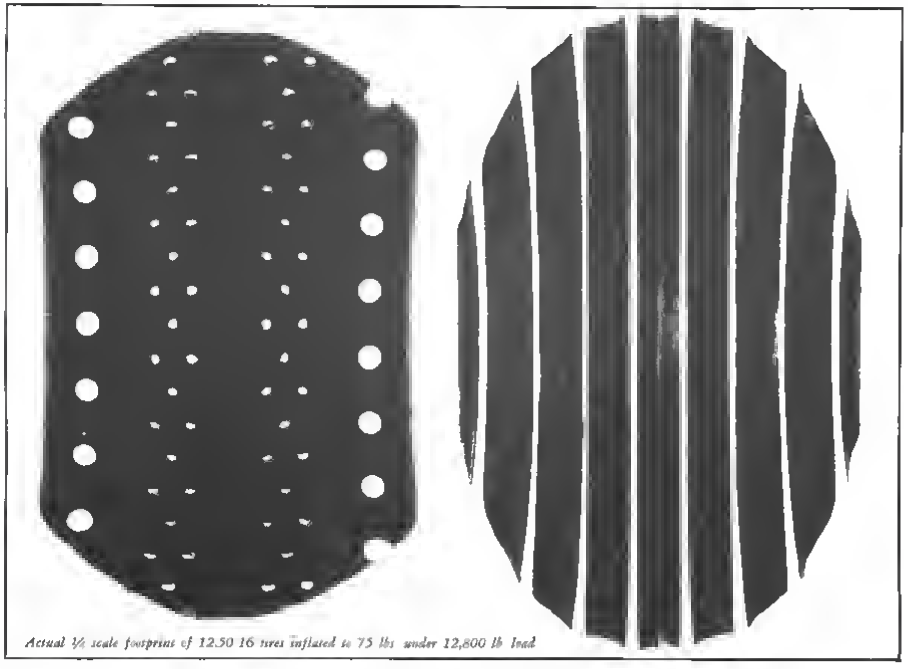
COVER: Beech Model 73 primary trainer is the first jet designed and built by the Wichita business plane manufacturer. Built with company funds, the Model 73 is undergoing flight evaluation at Naval Air Test Center, Patuxent River, Md. (also see p. 101). Powerplant is one 920-lb.-thrust Continental J69-T-9. Future development includes use of a 1,200-lb. thrust engine.

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Wilson's Record on Airpower

The sordid story of how American airpower has been forced to relinquish its once significant lead over all international competitors is being laid before the American people by the Senate Investigating Subcommittee headed by Sen. Stuart Symington, (D-Mo.).

This is not a new story to readers of AVIATION WEEK who have been given these facts over the past three years, long before the menace of Russian airpower was fully recognized on Capitol Hill or in the Pentagon.

Last week, Gen. Curtis LeMay testified in public (see p. 28), confirming in every detail the facts we have been presenting for some months previously on the relative decline of our long-range striking force in comparison with the fast-growing Russian capability. In a vain attempt to soften the impact of Gen. LeMay's harsh warning, Defense Secretary Charles E. Wilson has resorted to press conference buffoonery in an attempt to belittle both Gen. LeMay's position and the gravity of the crisis facing SAC during the next three years.

For example, to a reporter trying to penetrate Mr. Wilson's smoke screen of evasion on the real status of B-52 production acceleration, the Defense Secretary asked, "Do you own some Boeing stock?"

When queried about Gen. LeMay's testimony before the Senate Committee, Mr. Wilson brushed aside the question with the comment that he hadn't bothered to read the testimony. He also implied that Gen. LeMay was a "specialist" who always wanted more than he really needed.

Gen. LeMay's reputation as a "specialist" in strategic airpower was won in bloody combat over Germany and Japan and enhanced during the most critical years of the cold war when he molded the Strategic Air Command into a formidable atomic striking force that still is the major barrier between the free world and unbridled Communist military aggression.

Gen. LeMay's qualifications as an expert on airpower are too well known to suffer under Mr. Wilson's jibes, and his record of service can stand the light of any public scrutiny.

In contrast, Mr. Wilson's qualification as an airpower expert are less evident. His record on the subject badly needs a full public examination. Let us cite a few examples of Mr. Wilson's airpower decisions during his three years in the Pentagon that should be fully examined by the Symington Committee.

During his first few months as Defense Secretary in 1953, Mr. Wilson authorized a $5 billion dollar cut in the Air Force budget without bothering to explore details of how this would affect its military position. He later told Congress that nobody had told him how much this would affect the Air Force. At a time when technological progress was going faster than ever before and offered great opportunities to provide American airpower with vastly superior weapons, Mr. Wilson developed the constant level budget concept for research and development.

This concept has forced our technological progress to a much slower pace at the very time its maximum acceleration is vitally needed. If pursued much further, this constant-level budget for research and development will insure loss of technological supremacy to the Russians within a few years.

Mr. Wilson also proposed to handle all pure scientific research projects aimed at replenishing the almost dry reservoir of basic knowledge in a variety of new fields vital to weapons progress. He also pushed hard to cancel atomic-powered aircraft development. He was prevented from wiping out this program only by budgetary sleight of hand by former Air Force Secretary Harold Talbott. Mr. Wilson branded the intercontinental missile program as visionary and, at one time, would have wiped it out.

Finally when he realized his grave errors in the ballistic missile program, he threw a heavy monkey wrench into the then smooth working machinery of the USAF missile program by establishing four competitive programs. These new programs diluted the already critically-small reservoir of technical talent available, tangled the administrative procedures beyond recognition and diverted research and development funds from a host of other vital projects in the aerial weapons spectrum.

These are some of the highlights of Mr. Wilson's three-year stewardship as the chief decision maker in the Pentagon.

How has he fared in recognizing and evaluating the rise of Russian airpower that now poses the most serious military menace in the history of this country?

Early in 1953 when forcing the $5 billion USAF budget cut, Mr. Wilson told Congress that the Russians were building a defensive air force and that we were giving the Russians credit for aircraft "they just simply don't have."

In May 1954, the Russians publicly flew a prototype Bison long-range heavy jet bomber, displayed a squadron formation of medium-range Badger jet bombers, and the existence of their turboprop intercontinental Bear bomber was exposed by the aviation technical press.

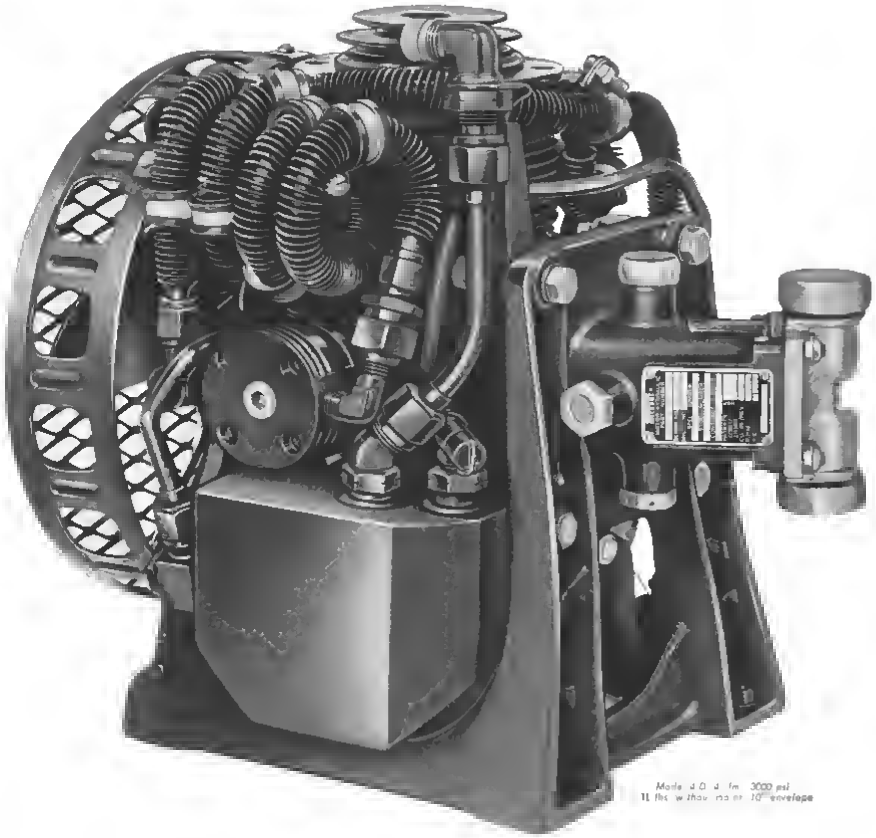
When confronted with this evidence of the Russian planes "they simply just don't have," Mr. Wilson brushed it off with the comment that the Bison was only a prototype, and that it would be five years before the Russians would have it in production.

A year later, the Russians flew a formation of 12 production Bisons. By the end of 1955, they had twice as many Bisons in their air force as the USAF had B-52s. When confronted with this evidence of production Bisons and large formations of two new fighters (the all-weather twin jet Flashlight and the supersonic Farmer), Mr. Wilson sagely told the press that these probably were hand built prototypes because the Russians really didn't understand machine-tool production.

Today, when confronted with incontrovertible evidence that the Russians are developing new planes in half the time it takes the USAF to do a comparable job, are outproducing us in key plane types such as heavy bombers and supersonic fighters and have a significant lead in ballistic missile development, Mr. Wilson shrugs it off as of little importance.

The American people should take a good hard look at Mr. Wilson and his airpower policies. Unless they are radically altered immediately, the history of this era may well record Mr. Wilson as the chief architect of the decline in American airpower at a time when the country needed it most.

—Robert Hotz



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WHO'S WHERE

In the Front Office

Theodore Hardeen, Jr., chairman inter departmental aviation manpower committee Defense Air Transportation Administration He succeeds **Frederick B. Lee**

Murray Simpson, assistant vice president, W. L. Maxon Corp., New York, N. Y.

Stanley Du Bois Ver Nooy, Jr. assistant to the president Air Express International

W. Watts Smith, manager of Westinghouse Electric Corp.'s Aviation Gas Turbine Division, Kansas City, Mo., and **A. M. Kennedy, Jr.**, purchases and traffic Pittsburgh, Pa., have been named vice presidents

H. L. Thackwell, Jr., assistant president Grand Central Rocket Co., Redlands, Calif.

Air Vice Marshal Frank Watt, (ret.), assistant to the president, Fleet Manufacturing Ltd., and Doman Fleet Helicopters Ltd., Ft. Erie, Ont.

Leonard G. Hunt, executive vice president and **James J. McNulty**, vice president operations, Emery Air Freight Corp.

Erwin Tomash and **A. C. Bellanca**, vice presidents marketing and administration respectively Telemeter Magnetics, Inc., W. Los Angeles, Calif.

Honors and Elections

Dr. Richard C. Carhart, staff scientist at Lockheed Aircraft Corp.'s Missile Systems Division has been named industry representative for the Defense Department's advisory group on reliability of avionics equipment

Changes

John H. Carter, associate research director, Lockheed Aircraft Corp.'s Missile Systems Division, Van Nuys, Calif.

Fred L. Roscoe, domestic sales manager Cessna Aircraft Co., Wichita, Kans. Also **Eldon M. Bloyd**, western divisional sales manager **O. W. Norris**, eastern divisional sales manager, **William W. Fergusson** divisional sales manager Cessna 310

Dr. Norton B. Moore staff engineer Aerophysics Development Corp., Santa Monica, Calif.

Walter Venghaus and **Herbert A. May, Jr.**, manufacturing manager and director of military relations respectively Flight Refueling Inc. Baltimore, Md.

Harold A. Jones, national sales manager Motorola Communications & Electronics, Inc., Chicago, Ill.

H. E. Schroeder production manager Royal Inc. Glendale, Calif.

J. C. Roberts airports and facilities director Braniff International Airways

Robert W. Powell, general sales manager Fafnir Bearing Co. New Britain, Conn.

Hermann T. Poeschl, manager Lear Electronics GmbH., Riem, Germany, a subsidiary of Lear, Inc.

Dr. Robert E. Corby, engineering staff Trio Laboratories Inc. Wantagh, N. Y.

A. R. Hunter, national sales manager Magnetic Research Corp., El Segundo, Calif. Also **Amos Bernstein**, applications engineer and **Sargent J. Ableman**, field sales and applications engineer

INDUSTRY OBSERVER

► USAF evaluation team is now reviewing its findings on Republic Aviation and North American Aviation Phase I entries and mock-ups for its supersonic fighter bomber. Recommendations are to be made to the Air Council this week, and, presumably, the last of the Phase I contests will be decided this month. Announcement of Phase II contracts for the tactical bomber to Martin (AW April 30, p. 32) and the long range interceptor to North American (AW Mar. 26, p. 23), are being held up by USAF pending decision on the fighter bomber.

► Air Force will provide dual-place fighter-trainer aircraft, such as the TF-102A, as part of the unit equipment for each operational fighter squadron. Under the plan, each squadron will be equipped with 21 single-place, high performance aircraft and four dual-place versions of the same basic models. An Air Force spokesman said the new plan is "expected to result in greater pilot proficiency and in a reduction in the loss of aircraft and pilots due to reduction in accidents."

► Air Force officials are looking upon Northrop's intercontinental missile, the turbojet powered Snark with renewed interest. A USAF spokesman, who indicated that the missile will be brought up to operational status within the near future, said the Snark has "demonstrated marked progress in the last six months."

► Although testimony before the House Appropriations Committee indicated that the Republic F-105 was programmed in the Fiscal 1957 budget, actual production orders will not be forthcoming until completion of flight tests of the F-105B, incorporating an area rule fuselage design (AW Apr. 9, p. 25). The B aircraft, completed at Republic's Farmingdale plant, will be flown soon at Edwards AFB.

► Lockheed's C-130 transport, its production schedule delayed by propeller difficulties is scheduled to reach USAF operational units sometime in December. Originally fitted with Curtiss-Wright propellers, the C-130 will be converted to Aeroproducts' units. Difficulties with the Curtiss-Wright product already has delayed delivery of the initial model to the Air Force Proving Ground at Eglin AFB, Fla., by at least two months—from April 15 to an estimated June 15.

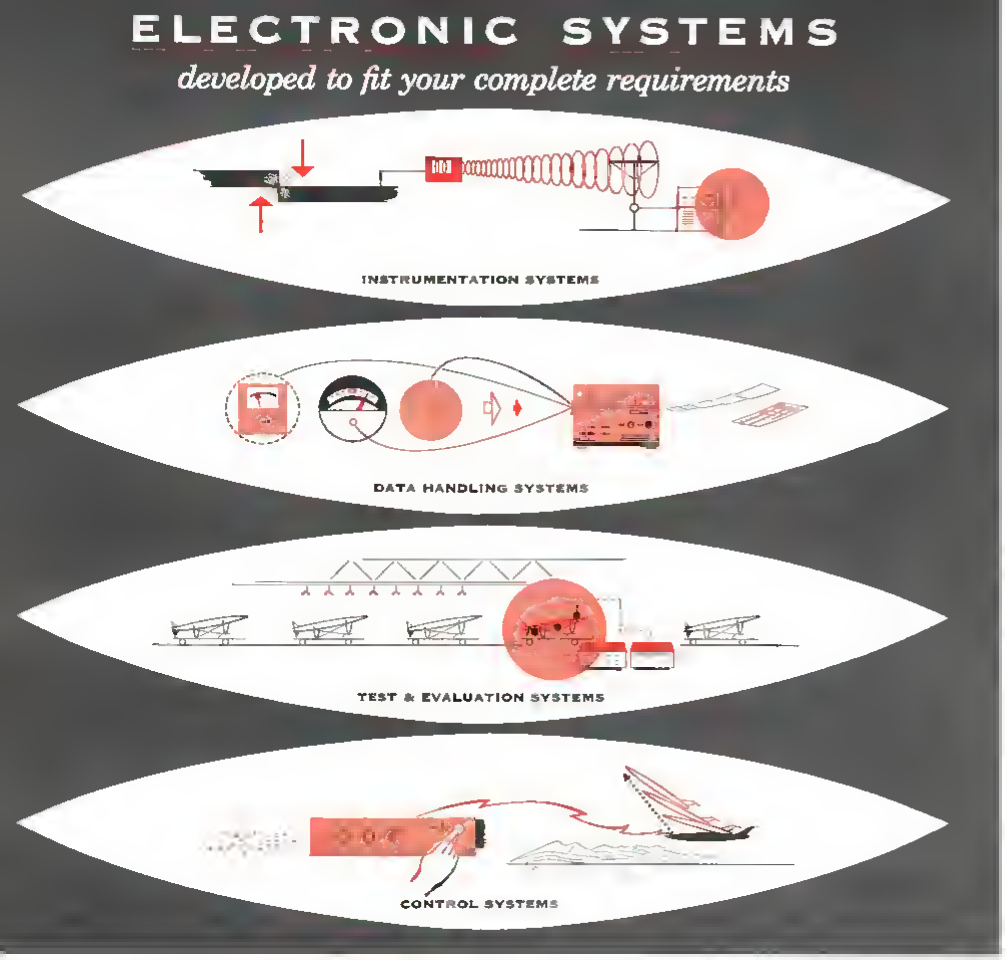
► Initial flights of Convair's B-58 Hustler are scheduled for sometime later this year. Air Force won't ask for funds for their production procurement until Fiscal 1958.

► Army Corps of Engineers has awarded a $420,900 contract to the Noble Co., Oakland, Calif., for the installation of bridge cranes for three missile assembly buildings to house Convair's Atlas intercontinental ballistic missile at Patrick AFB, Fla.

► Fairchild's F-27 turboprop airliner will have less high-pitch taxiing scream than the Vickers Viscount. Sound traps on Rootes blowers used to pressurize the Viscount are located between blower and cabin inboard of overboard dump. Sound trap on the F-27 is located adjacent to the blower and suppresses sound ahead of the overboard dump. Both aircraft have Rolls Royce Dart engines. Compressor whine will still be present on the Friendship.

► Sikorsky Aircraft's production of S-58 helicopters for civil operators has been delayed by additional military commitments, including deliveries to the French for use in Morocco. One S-58 per month is now coming off the Sikorsky line. New York Airways is first in the civilian line and expects its initial S-58 this summer, probably in June. Sabena Belgian Airlines is next in line but won't receive its first aircraft until next year.

► Flying pipe-type buddy refueling system is under development for Republic Aviation. System is to be flown this summer in an F-84F for evaluation of possible use on Republic's F-105.



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Washington Roundup

Speed Policy Reversed

Watch for Defense Department to reverse its ban against official world speed record runs under Federations Aeronautique Internationale rules to permit the Lockheed F-104A to recapture the record from England. The 1,400 mph USAF day supremority fighter and other USAF and Navy fighters in the better than 1,000 mph class previously had been barred from making these official record runs by Defense Department policy that erroneously labeled such performance as top secret. Actually the official speed runs at 35,000 to 40,000 ft. altitude offer no real data on the combat capabilities of a modern aircraft that must fly and fight at better than 50,000 ft. Present world speed record of 1,132 mph was set by the British Fairey FD2 research plane after the Defense Department ban had prevented the Navy's Vought Crusader and the McDonnell Voodoo from raising the record to over 1,000 mph from the 822 mph of the North American F-100C.

Money Is Money

There will be growing industry effort to have the Defense Department judge an executive's pay on how much he makes rather than how it is paid. National Security Industrial Assn. has passed this advice on to Comptroller Wilfred J. McNeil and Assistant Secretary Thomas P. Pike.

Sole test of compensation should be whether it is reasonable, NSIA argues. It should make no difference whether it is labeled as salary, bonus, shared profits, fees or royalties, pensions or retirement benefits. Proposed revision of Armed Services Procurement Regulations Section XXV would make some of these costs not allowable in military contracts. If the compensation is reasonable, NSIA says, "The burden of proof should be regarded as having been met."

Shortage of Scientists?

Dr. Jerome Hunsaker, Chairman of the National Advisory Committee for Aeronautics, has decided that he was too effective in impressing the House Appropriations Committee with the shortage of scientists and technical personnel.

The committee cut NACA's personnel budget for fiscal 1957 by $1.5 million on the grounds that it couldn't be used, saying: "The agency has experienced considerable difficulty in filling scientific and technical positions."

Pleading with the Senate Appropriations Committee to restore the funds, Hunsaker admitted that he had overstated the situation to the House group. If the funds are not restored, he said, NACA would be prevented from employing 424 personnel "urgently needed for an acceleration of effort in critical fields of research."

Air Force's Lt. Gen. Donald Putt, Deputy Chief of Staff for Development, joined Hunsaker in supporting restoration of the total $5.2 million cut made by the House in the NACA's Fiscal 1957 budget. A total of $79.7 million was asked. The House voted $74.5 million, higher than the Fiscal 1956 budget of $72.7 million.

Hunsaker told the committee: "To cut back the research effort at this time is extremely inconsistent and highly dangerous."

Putt reported: "Our weapons have now gotten into an area where there is a great lack of knowledge. . . . We are almost in a situation that we are having to do things without knowing what we are doing."

Single-Monoger Concept Spreads

Pentagon's single-manager concept has made its first step into the aviation field. Defense Department's effort to centralize commercial contracts finally has given the Army the upper hand over air service with the assignment of Secretary Wilber Brucker as single manager for all forms of military transportation within the United States. New directive orders Brucker to set up a Military Traffic Management Agency with an executive director to manage all commercial freight and passenger transportation used by the Armed Forces. Coming step: the Single Manager Program will be applied to airlift services, including Military Air Transportation Service. Watch for growing inter-service irritations if Army or Navy is handed cognizance in this area.

SAC Begins Dispersal

Strategic Air Command will begin its dispersal policy this summer with the transfer of the 99th Heavy Bomb Wing from Lanchild AFB in Washington to Westover AFB in Massachusetts during the process of converting from B-36 to B-52 aircraft. SAC's goal is to disperse each of its bomber wings to a separate air base but this process will be hampered by Defense Department limitations on base constructions funds.

MATS Bedeviled

A ten-old Hoover Commission report recommending that the Military Air Transport Service "be restricted and realistically limited" reared up again during Air Force budget hearings before the House Appropriations Subcommittee.

Subcommittee members prodding Air Force officials on competition offered the airlines by expanded MATS services introduced Perry M. Shoemaker, president of the Delaware, Lackawanna & Western Railroad and chairman of the Hoover Commission Committee on transportation activities within the Defense Department.

Shoemaker startled subcommittee members and MATS officials alike with the statement that—based on projection of traffic figures for July 1954—the Hoover Commission had placed MATS domestic passenger traffic for Fiscal 1954 at 1.8 million persons. (In comparison, Braniff Airways carried approximately 1.6 million passengers in Fiscal 1955.)

After long consultation, the MATS officials provided its own figures and said the Commission survey—to have arrived at such a high number—must have included all the "hitch hikers" carried on any and all Air Force planes and probably personnel carried aloft on training missions as well.

The MATS estimate also based on July, 1954, figures placed its domestic passenger traffic for the fiscal year at 68,616.

"The movement of 1,832,000 passengers attributed to MATS," the officials said, "cannot be reconciled with records available to the Air Force."

—Washington staff

Gen. LeMay Gives Russia Four Years to Outstrip U.S.

SAC commander tells Senate committee present policies will give USSR air superiority by 1960.

By Katherine Johnsen

Washington—Strategic air superiority will shift from the United States to Russia within the next four years under the Eisenhower Administration's present defense program, Gen Curtis E LeMay testified last week before the Senate Armed Services Subcommittee

The Strategic Air Command commander told the subcommittee headed by Sen Stuart Symington (D Mo) that, if this is not to happen, the U S must:

- Increase B-52 production
- Provide an even greater increase in jet tanker production since he said, the present ratio of tankers to bombers is inadequate
- Give "increased and vigorous attention today" to assure air superiority beyond the 1958-60 period

Earlier Warnings

Prodded by apprehensive public statements by Gen Nathan Twining USAF Chief of Staff and Gen Thomas D White USAF vice chief of staff the Administration on April 9 submitted a supplemental Fiscal 1957 budget request of $248 million to Congress The request would be used to increase the procurement of B-52's and step up the jet bomber's production rate LeMay's position is that this increase is still inadequate

Following LeMay's testimony Secretary of Defense Charles Wilson left the door open for a further increase in the B-52 program, but said he saw no urgency in the situation

Pointing out that "in a few months" consideration of the Fiscal 1958 defense budget will start Wilson said

This money (the $245 million supplemental) carries the thing at this higher production rate until we can get '58 funds When we get '58 funds if we want some more B-52's all we have to do is put the orders Fiscal 1958 funds would not be available until July, 1957

LeMay also stressed the need for concentrated effort on the program for a successor manned-bomber to the B-52 (The Air Force already is developing a nuclear-powered and chemically-powered bomber as possible successors)

LeMay's View of ICBM

"The intercontinental ballistics missile," LeMay declared has a potential of being a good weapons system in the future We should by all means, press forward with our research and development program to produce this weapon at the earliest possible date However there are many difficult problems in this program and I believe that the first model of the weapon both ours and the Russians will be less efficient than the manned bomber

"As time goes on this efficiency should increase and the weapon become more reliable and useful I think it reasonable to say that the first ICBM will augment the manned bomber force But I do not believe that in the foreseeable future the ICBM will replace all of the bomber force

Therefore, it is most important that we address our efforts and our scientific and production capabilities to the development and production of the manned bomber follow-on or successor to the B-52/KC-135 combination at the earliest possible date

Meanwhile, Lt Gen Donald Putt, deputy chief of staff for development, recommended a $150 to $200 million increase in the USAF research and development budget for Fiscal 1957 in testimony released by the House Appropriations Committee

"I think" Putt said, "we are ahead (of Russia) generally across the board now However it is important to us today is the rate at which they are catching up If we are going to reverse that trend in time action has to be taken today and not after they have caught up with us"

He pointed out that the research and development budget—now planned at $611 million for Fiscal 1957—has remained approximately "level" for several years He added:

"You cannot continue to increase your capability or match the requirement with a level dollar budget because each succeeding generation of weapons becomes more complex and more costly."

Putt specifically testified that there should be greater research effort on the X-15 on a long-range interceptor, defensive weapons against the ICBM and advanced propulsion systems

Current B-52 Output

The total amount for financing the B-52 program up to July 1 is $3.8 billion This includes allocations for initial spares and related equipment but not industrial facilities Current production is approximately six planes a month

A total of 47 have been accepted by USAF thus far 15 planes produced in February March and April were not accepted by the Air Force, LeMay said, because of a serious but correctable components failure The failure which is not delaying production, was in the flywheel of a small electrical alternator It was responsible for last winter's B-52 crash near Travis AFB.

LeMay described Russia's Bison bomber as "comparable" to the B-52 in performance He said the other long-range bomber in the Russian strategic force, the Bear is a turboprop powered aircraft and therefore its performance is greater in range but less in speed and in altitude than that of the B-52."

Production of the Bison at present is at a higher rate than that of the B-52 if our estimates are correct" LeMay testified Combined Bison and Bear production, he said, is "substantially" higher than B-52 production

LeMay said SAC's 36 tanker squadrons (no jets) now give a reasonably adequate refueling capacity However as our relative strength declines in the future we could use more refueling capacity I know of no plan that will furnish the number of tankers necessary to give us maximum efficiency"

Decline in Power

Following are key questions asked by the Symington subcommittee and LeMay's replies

- **If no changes are made** in the present plans and programs for SAC will its power to discharge its responsibility weaken between now and the period of 1958-60?

"The present plans for SAC will insure an increase in combat capability between now and 1960 However in spite of this increase if our estimate as to what the Soviet production in the long-range bomber field is correct SAC's relative power to discharge its responsibility will decline during the time period"

- **Is it not a fact that** we do not now plan to increase our rate of B-52s to a point where it will equal the Russian rate of production of their two modern type bombers?

"The Air Force does not now plan to increase the rate of production of B-52s to a point where it will equal the estimated combined rate of production of their two modern type bombers"

- **Is it not a fact that** the Russians now have in their air force more modern long range bombers than we have?

"I assume you do not consider the B-36 as being a modern bomber We believe they have more Bisons and Bears in their inventory than we have B-52s

- **Assuming no change in our present** plans and programs, what, in view of our estimate of Russian production, would be the approximate relationship between our modern long range aircraft force and that of the Russians by the period 1958-60?

"At the period 1958-60 the Soviet air force will have substantially more Bisons and Bears than we will have B-52s"

- **Is it not a fact that,** unless there is a change in our present plans and programs, the Russian long-range air force will have greater striking power than SAC by the period 1958-60?

"It is very difficult to answer unequivocally a question dealing with striking power during this time period Striking power is a function of aircraft, weapons, bases, refueling capability maintenance and training Under the assumptions stated, the Soviets will enjoy a numerical advantage in long-range bombers We would be foolhardy to assume they would not also provide the weapons bases refueling capability maintenance capacity training and professional personnel to support this numerical superiority in aircraft I can only conclude then that they will have a greater striking power than we will have in the time period under our present plans and programs."

- **Is it not valid that** SAC's strength be considerably more than the strategic air strength of Russia, because the U S would never make the first all-out nuclear attack and much of its strength would be destroyed if the enemy made such an attack?

"If we suffer a surprise attack, it is reasonable to assume that we will suffer losses to our force The remainder should be strong enough to inflict damage on the enemy that will be unacceptable to him if we are going to succeed in deterring an attack in the first place It is then reasonable to assume that the original force without losses should certainly be initially stronger than the Soviet force"

Wilson concurred with LeMay that Russia is now building long-range bombers at a somewhat higher rate than we are Noting that he had not studied LeMay's testimony, he said

"If you added up the desires and the stated needs and ambitions of all your specialists you would have an impossible total on your hands not only in money but of the people to carry out the program I don't mean to be critical of Gen LeMay I am just explaining that naturally, he is stating the problem as he sees it from his particular part of it"

SAC Wing Structure

The present composition of SAC's 51 wings as detailed by Gen LeMay last week was decided upon in 1953 at the beginning of the Eisenhower Administration Under the Truman Administration, SAC's planned strength was established in 1951 at 57 wings

	1951 Program	1953 Program
Heavy Bomber	7	11
Medium Bomber	30	28
Strategic Reconnaissance (heavy)	4	0
Strategic Reconnaissance (medium)	6	5
Fighter Escort	10	0
Strategic Reconnaissance (fighter)	0	1
Strategic Fighter	0	6
TOTAL WINGS	57	51



SAC COMMANDER Gen LeMay and Maj Gen McConnell with Sen. Symington.

Last ICBM Barrier Breached

Washington—Two Air Force generals with a direct control over the USAF's intercontinental ballistic missile program testified that the last technological barrier blocking its development has been breached

What remains before its final appearance as a usable weapon is a "systems engineering job of great magnitude and testing"

In testimony before the House Armed Services Subcommittee on Appropriations given on March 6 but released only last week Maj Gen B A Schriever commander of the Air Research and Development Command's Western Development Division, told subcommittee members "there are no inventions required" to produce an effective ICBM

"It is," he added, "just applying the state of the art and we stretch it at certain places We see no reason why we cannot do it (produce an ICBM) on the schedule we have set up"

Warhead Breakthrough

The actual schedule for the missile's development was part of the testimony deleted in the heavily-censored version of the hearings released to the press

Before the same subcommittee Maj Gen S R Brentnall USAF assistant chief of staff for guided missiles confirmed AVIATION WEEK reports of the breakthrough in the development of a lightweight high-yield hydrogen warhead (AW Feb 29, p 27) that makes an effective ICBM feasible

Brentnall said that in the early stages of development "warhead size imposed

severe requirements in the areas of guidance, propulsion and re-entry which were beyond the state of the art."

This roadblock was solved, he said, when

"The advent of lightweight, high-yield warheads made ballistic missiles attractive because it simplified the many technical problems and insured that thermonuclear explosives would be light and handy enough to be carried by long-range missiles of reasonable size.

"The breakthrough changed the nature of scientific war by simplifying the development of a usable long range missile."

Testifying within a framework of debate inside and out of Congress that the Administration's Fiscal 1957 budget program is budget-wise and security-poor, both generals said that the intercontinental ballistic missile program, at least, has not been hampered by lack of funds.

In answer to a direct question by Rep. George H. Mahon (D.-Tex.), as to whether the budget requests were sufficient, he said: yes ... at the present time."

Later, Schriever said, "we have not been at any time delayed in our program for reasons of funds." The greatest problem, he added, lies in the fact that "there is not an unlimited reservoir of scientists."

Procurement Policies Defended Before House Group by USAF

Washington—The Air Force pointed to over $1 billion it has recaptured on aircraft contracts through an "aggressive" review policy in defending its procurement practices before the critical House Appropriations Subcommittee on the Armed Services.

A comprehensive report by the subcommittee's staff hit at numerous aspects of USAF's procurement administration (AW Mar. 26, p. 26). Among the charges:

- "Frequent delays in establishing firm target prices on incentive and price redeterminable type contracts have seriously impaired the government's negotiating position."
- "Unconscionable delays have taken place in formalizing letter contracts into definitive contracts, diluting the government's opportunity to obtain fair and reasonable prices."
- "Weaknesses in requirement computations, inaccurate inventories, inadequate stock records, excessive paperwork and lack of price control have hindered efficient and economical procurement of spare parts."

Dudley C. Sharp, Assistant Secretary of the Air Force for Materiel, assured the subcommittee that "we are taking action on all" of the criticisms in the report.

Recaptures

The $1 billion recapture resulted from a review of 2,300 USAF contracts for Fiscal 1955 and previous years. It included a reduction of $705.3 million in aircraft (complete) contracts for these programs: B/RB-47, $261.5 million; F-86D, $39.1 million; F-89C/D/H, $94 million; KC-97C, $49 million; F-100, $38.6 million; B-36, $11.7 million; F-86E/F, $10.9 million; others, $15.9 million.

Since there were increases in guided-missile costs of $96.3 million, the net recapture was $963.3 million—$608 million of this was channeled into the intercontinental guided missile program.

The Fiscal 1955 Defense Appropriation Act originally directed the special reviews. Sharp told the subcommittee that "the gratifying results have indicated to us the advisability of establishing these reviews on a continuing basis."

Rep. George Mahon (D.-Tex.), chairman of the subcommittee, commented that the recapture "may very well be an indication of excellent management in the current fiscal year."

He added, "but I would interpret it to mean you did not have especially good management in Fiscal 1955 and prior years."

Rep. Jamie Whitten (D.-Miss.) observed that "in many instances reflected in your so-called recoupments, the return of money to the government was voluntary on the part of the contractors."

USAF Procurement Policy

Policies the USAF is pursuing to hold down procurement costs, as reported by Sharp:

- **By emphasizing quality in aircraft procurement** and phasing in guided missiles. "We are equipping wings with fewer aircraft and a corresponding lesser airframe weight."
- **By "tightened management"** in handling spare engines, overall engine requirements have been reduced. "We have been able to return to the aircraft production line for installation of certain engines initially acquired as spare engines."
- **Through improved inventory** and other controls, requirements for initial spares have been reduced. "Even with the increased introduction of new and progressively more complex aircraft weapons systems, we have been able to bring the percentage of dollars required for initial support down from 44% of the program cost of aircraft procurement in Fiscal 1951 to 25% for Fiscal 1956."
- **Modification costs** have been cut. "We now consider for modification only those aircraft scheduled to remain in the active inventory two years after the modification, rather than the one year previously stipulated."
- **By withholding the placement of contracts** until necessary to meet schedules, the USAF has been able to achieve closer control of price, quality and delivery factors. Lead time has been reduced from 20 to 18 months. (Maj. Gen. T. P. Gerrity, assistant for production programming, deputy chief of staff for materiel, added to Sharp's statement. The reduction has "not only reduced the quantity of funds required for forwarding financing on the part of the government but will help promote competition in the industry by reducing dollar backlogs of business. It also promotes better pricing by reducing some of the contingencies associated with long lead-time contracts.")
- **There has been a "notable"** cutback in procurement by "letters of contract"—which give the government only a loose control over pricing. There were $4.4 billion contract letters outstanding in February, 1952, as compared with $1.1 billion by November, 1955.

Investigator Report

Although Air Force procurement policies "may read very, very good," Whitten said subcommittee investigators found "poor or shoddy practices" in the specific cases they examined. He added:

"These investigators say that much of your contracting is sound in theory ... but that it is dependent upon the accuracy of the original target price set—and that frequently this seems to be completely out of line."

Whitten pointed out that, if a high target is set, the contractor stands to reap "one whale of a big profit"—since contractor and government split the "saving" between the target price and the actual price.

Gen. Gerrity agreed that determination of the target price "is exactly the crux of the matter."

Subcommittee members urged the USAF to concentrate on cutting costs which account for 90% of the contract price—rather than profits.

Commenting on USAF testimony that the profits of aircraft manufacturers are about half that of the general industry level, Mahon declared: "That is not important.

"If you take a man and set him up in business and give him the tools and equipment and, maybe, the plant or part of the plant, and then give him $1 billion in contracts—or hundreds of millions of dollars in contracts—and his profit is only 2% or 1%—does not mean that the profit is low. ... Private enterprise is a different situation. It is a million miles different' from the aircraft industry situation."

Whitten pointed to aircraft stock rises as an indication of high profits off government business. "When you find aircraft stocks were selling ... from $7 to $8 a share and that once the government starts giving contracts, it jumps up to around $100, that within itself is some indication of the earnings. ... It shows purchasers recognize how much money they are making."

Sharp argued that aircraft manufacturers should be considered as "management companies" receiving "fees" for their services. He added that, "At present I feel that the fee is fairly reasonable, and (that) it is very close to being the right fee." Sharp pointed out that the USAF deals in specific contracts and that responsibility for overall consideration of the financial position of a company, as a result of government contracts, is up to the Renegotiation Board.

Committee members applauded USAF's policy of disallowing bonus payments as contract costs. "We are against it," Mahon flatly declared.

Sharp endorsed the payment of incentive executive bonuses—out of "fair profits" allowed a company from company business—as preferable to straight salary increases.

He commented: "I feel that if they paid them a straight salary with no incentive (for performance)—that, perhaps, the individuals would not be quite so active and efficient in trying to add to the profit of the corporation by cutting down the cost to the government."

Additional Lower Fare Service Proposed by PAA

A plan for three classes of overseas passenger service, with a new lower-fare tourist service at the bottom of the scale, will be offered by Pan American World Airways at the International Air Transport Association traffic conference May 29 at Cannes (AW Apr. 30, p. 25).

Under the plan, passengers would choose from first class, cabin class, or tourist. Cabin class would provide the same service as today's tourist flights. The new tourist service would cost 15 to 20% less than present tourist fares.

On a New York-Paris round trip, Pan American's plan would cut the tourist fare from the present $588 to $458.

Frank Piasecki Challenges Vertol, Showdown Near on Board Seats

By Claude Witze

Morton, Pa.—One of the bitterest inter-company fights in the history of the aircraft industry will come to a climax this week at the annual meeting of Vertol Aircraft Corp.

In a last-ditch effort to elect his nominees to the board of directors, Frank N. Piasecki, ousted chairman and company founder, has challenged the stewardship of president Don R. Berlin, largely on the basis of Berlin's position as a representative of the Laurance Rockefeller interests which control the company.

Replying to 21 questions posed by Piasecki in a display advertisement in a Philadelphia newspaper, Berlin told shareholders the 37-year-old founder was successful in promoting an idea but unsuccessful in making a going business of it" until Rockefeller entered the picture ten years ago.

Berlin accused Piasecki of making no direct charges against him, but of insinuating there has been serious mismanagement since he became operating head of the firm, then known as Piasecki Helicopter Corp., in 1953. Before Berlin, C. Hart Miller became president of the company in April, 1949, when Piasecki was removed from that job for what Berlin has described as his failure to "qualify as a top operating executive."

During his tenure, Miller also was at odds with Piasecki at frequent intervals, but the basic disagreement did not break into the open until a year ago when the young inventor was removed as board chairman.

This step was taken, according to Berlin when Piasecki lost his responsibility over the company's research and development program. Berlin said the directors ordered him to take charge of these projects in February, 1955.

Following formation of a new Piasecki Aircraft Corp., Vertol's shareholders adopted a by-law banning officers of competing companies from their board. This has the effect of removing Piasecki and two of his aides, Donald N. Meyers and James J. Davis.

In his newspaper advertisement, Piasecki implied that Berlin or Rockefeller were withholding the record of their performance from the stockholders.

In reply, Berlin said the basic issue is the number of directors to be elected by a competing company. He insisted that the company management will "measure up fully to the highest standards of integrity and best corporate practice."

In his question-type accusations,

New Plant for Atlas

San Diego, Calif.—Convair will break ground this month for a $41 million missile plant near LaJolla for research, development and production of its SM-65 Atlas intercontinental ballistic missile and related equipment.

The plant will have one million square feet and be ready for full operations in October, 1957. By 1958, Convair expects to employ 6,600 people in the plant.

The new missile plant site is located on a 280-acre tract in Sorrento Canyon a few miles east of LaJolla and is near a new Air Force site now under construction at Sycamore Canyon for the static testing of the Atlas.

The first launching equipment for the Atlas development test program is under construction at the USAF missile test center, Cape Canaveral, Fla.

The USAF will pay $20 million of the plant's cost with Convair financing the remaining $21 million. The firm of Pereira and Luckman of Los Angeles has been awarded the contract for engineering and architectural work on the new missile plant.

J. R. Dempsey, director of the Atlas program since 1954, will head the Sorrento plant. Kerel J. Bossart, who has been a key figure in Convair's ballistic-missile program since 1945, will be chief engineer at Sorrento with Mort Rosenbaum, former chief project engineer at Convair's San Diego Division as his assistant.

Other appointments to the new missile division include: Operations manager, W. L. Young, former works manager of San Diego's Plant 1; manager of administrative services, D. C. Burrows, former controller for the San Diego Division; manager of contracts, C. W. Blakely, former director of general accounting for Convair.

The prototype Atlas is under construction at Convair Plant 1 in San Diego and is scheduled for test firing in 1957 at Cape Canaveral, Fla.

Piasecki emphasized the fact that two Rockefeller representatives on the Vertol board also serve as directors of other aviation concerns. They are Harper Woodward and T. J. Walkowicz who represent Rockefeller's substantial interest in Marquardt Aircraft Corp., Reaction Motors Inc., Flight Refueling, Inc., New York Airways, Inc., Airborne Instruments Laboratory and Eastern Air Lines. Woodward at one time also was a member of the board at McDonnell Aircraft Corp. where Berlin served as vice president before turning to the helicopter company.

Piasecki also mentioned the name of John I. Floberg, a director of both Vertol and Flight Refueling, along with Woodward. Piasecki implied that Berlin had refused to compete with Flight Refueling.

In his reply Berlin denied that Vertol is competitive with any of the firms named by Piasecki. The only exception to this is McDonnell, from which Woodward resigned as a director in 1952.

Berlin made these other points in reply to Piasecki questions:

- **Vertol attempted to retain** a relationship with Piasecki by an agreement to hire his new company for outside engineering services. Negotiations collapsed when Piasecki Aircraft started to compete with Vertol, seeking government contracts for overhaul of H-21 transmissions and rotor blades.
- **Vertol has never submitted** a bid in competition with Piasecki Aircraft at a price calculated to lose some money.
- **Berlin has not "borrowed"** money from Vertol. He has purchased stock for cash and secured notes under terms of an agreement signed by Piasecki when he was board chairman.
- **Berlin's son is associated** with a former Vertol subcontractor. This subcontract was cancelled with approval of the USAF, at little disadvantage to Vertol. He gave no explanation.

The conflict between Piasecki and Vertol over the number of directors to which the minority is entitled centers around an argument over which voting record should be used as a basis for the allocation. Piasecki cites a split of 263,736 to 121,510 votes in a ballot of October, 1955, on the issue of adopting a stock plan.

Berlin, on the other hand, says the basis should be the vote of April 5, 1956 which passed a by-law defining the qualification of directors and making Piasecki, Meyers and Davis ineligible. This time the vote was 309,248 to 1,254. Only 11 shareholders supported Piasecki's case.

Demanding four directors instead of three, Piasecki has nominated Grace G. Burns, president of Granburn Steel Co.; Louis M. Cohen, a Philadelphia attorney; Henry A. Hofmann, president of Hofmann Industries; Edward B. Stokes, a partner in a Philadelphia brokerage firm; and Frederick P. B. Thornton, of a Philadelphia automobile concern. He is seeking proxies to support this slate.



Martin B-57E Target Tug

Two long tubes on underside of B-57E contain high speed aerial targets used by fighter aircraft and ground forces to sharpen their skill with anti-aircraft rockets. Four targets are carried at one time. Target gear is quickly removable enabling B-57E to revert to its tactical bomber role. Target cable reels are carried in rotary bomb bay.

Gust Loads Probed To Aid Jet Operations

Washington—A new high altitude research program on the effects of gust loads to aid future jet airline operations will be conducted by the National Advisory Committee for Aeronautics with a trio of Lockheed U-2 subsonic flying test beds.

The Lockheed U-2 is a subsonic research plane powered by a Pratt & Whitney J57 turbojet that has been used by the Air Force for flight testing turbojet fuel flow systems at high altitudes.

It can operate routinely above 50,000 ft. and has been flying off an Atomic Energy Commission airstrip at Watertown, Nevada.

In addition to the Lockheed U-2s, NACA expects to use other aircraft, such as B-47s made available by USAF's air weather service. The USAF indicated that several more Lockheed U-2s will be built in addition to the trio now flying. The NACA program will aim at securing more precise information about clear air turbulence, convective clouds, wind shear and the jet stream, cosmic rays and concentration of certain elements in the atmosphere such as ozone and water vapor.

Initial flight testing will be done over the Rocky Mountain area but NACA plans to extend the program to USAF overseas bases where technical and logistical support will be furnished to the agency by the USAF Air Weather Service.

Electra Research Cuts Lockheed Earnings

Increased research and development expenditures on the turboprop-powered Electra transport caused a decline in Lockheed Aircraft Corp.'s earnings in the first quarter of 1956 compared with the same period last year. President Robert E. Gross told stockholders last week.

First quarter earnings totaled $4,413,000, 4% under last year's initial quarter total of $4,596,000. Research costs for the 1956 first quarter were $4,025,000 compared to $1,777,000 a year previously. Gross noted. Percentage of earnings to sales was the same during both years, 2.4%.

Sales through March 25 totaled $187,657,000, down 1.4% from the $190,453,000 earned in the first quarter of 1955. But the company's backlog increased 18% to $1,277,397,000 on March 25, up $191,996,000 over the same 1955 date and $58,420,000 more than the total unfilled orders at the end of 1955.

Commercial backlog totaled $432,255,000, accounting for 34% of Lockheed's total unfilled orders and the highest dollar and percentage portion since the end of World War II.



New Navy Roles for Cougars

Versatility of Grumman's sweptwing F9F-8 Cougar jet fighter has been increased by adapting it to a transonic two-seat trainer (top photo) and high speed photo-reconnaissance (bottom) roles. Plane is capable of crossing the U.S. in less than four hours. The F9F-8T trainer of which over 100 are on order, will be delivered this summer, half will go to fleet units, half to Training Command. It will be the Navy's first operational transonic trainer. Armed with two 20-mm. cannon, half the normal number, it also carries external weapons and is adaptable to combat missions. The F9F-8P photo plane is now in operational service, fitted with a nose probe for inflight refueling. Still cameras are made by Fairchild Camera and Chicago Aerial Industries; Mitchell supplies movie cameras and Specialties, Inc. the automatic lens cones. Grumman developed the F9F-8P from wooden mockup to production airplane in eight months. First flight was Aug. 21.



Other Reports

- **General Dynamics Corp.** had net sales of approximately $173,473,000 in the first quarter ended March 31st, compared with $159,241,000 for the same period in 1955. Profits before taxes for the initial 1956 period are estimated at $9,023,000 compared with $9,354,000 for the same period last year. General Dynamics backlog as of March 31 $1,653,000,000 and contracts under negotiation $370 million.
- **The Martin Co.** reported a drop in sales for the first quarter compared with early 1955, but expects an increase in subsequent quarters. Sales as of March 31 totaled $51,132,853 compared with $61,409,537 in the first quarter of 1955. Net income for the first quarter totaled $1,586,725 compared with $2,111,669 in the first three months last year.
- **McDonnell Aircraft Corp.** reported that for the third quarter of its fiscal year ended March 31st, unaudited earnings after taxes were $4,399,312 on sales of $131,394,768 compared with earnings of $3,198,709 on sales of $109,270,431 in the first nine months of fiscal 1955. Backlog on March 31, 1956 was $627,498,320 an increase over $305,438,023 at June 30.
- **Bell Aircraft Corp.** reported sales of $45,203,181 in the initial quarter ended March 31st compared with $48,448,906 for the same period last year. Income was $1,634,880 for the first three months of 1956 as against $1,581,495 last year. Backlog at the end of the first quarter $224,256,442.



THREE RUSSIAN Tu-104 AIRLINERS, parked at London Airport inside 20 roundtrips between Moscow and London during the Bulganin-Khruschev visit, ferrying gifts, supplies and personnel. Plane numbers 5400, 5412, 5413 suggest more than 10 are flying somewhere.

Red Jet Service to London



FIRST PILOT Ivanov at Tu-104 controls



RECLINING, swivel chairs in small cabin



FIGURINE decorates cabin separator



TELEPHONE links galley with passengers.

MAIN COMPARTMENT has large reclining seats, gray walls, beige ceiling, green carpet





LACE maintains taste for Victorian decor

Zimmerman and Rescue Teams Share Helicopter Honors Forum

Washington—Dramatic disaster rescue work by helicopters in 1955 won top level recognition last week from the American Helicopter Society.

For the first time in the society's 12-year history, the Kossler Award for "most outstanding practical application of the helicopter in the past year" was given to multiple recipients, the U. S. Army, Air Force, Navy, Coast Guard and the helicopter industry.

In addition, the society honored Charles H. Zimmerman of the National Advisory Committee for Aeronautics. Zimmerman received the annual Dr. Alexander Klemin Award largely in recognition of his early contribution to the flying platform. His work in this project goes back to the mid-forties, was perfected under NACA auspices and now is under further development by the industry.

The awards were presented at the society's Honors Night Dinner, a highlight of the 12th Annual Forum, held in Washington last week. Along with the prizes, honorary fellowships in AHS were presented to Jackson E. Beighle, sales manager of Sikorsky Division, United Aircraft Corp., and Fred L. Dohlhoff, chief helicopter engineer of McDonnell Aircraft Corp.

Rescue Operations

Rescue work performed by helicopter units in 1955 was at the scene of the year's disastrous floods. These were scattered from New England and Pennsylvania to California and Tampico, Mexico.

Aircraft and pilots contributed by all of the armed forces and the industry took part in sensational rescues, saving thousands of victims from rooftops, trees and other inaccessible spots.

Accepting the awards at the AHS dinner were Lt. Gen. James M. Gavin for the Army, Rear Admiral J. S. Russell for the Navy, Lt. Gen. C. L. Schilt for the Marines, Maj. Gen. I. P. Gerrity for the Air Force, Vice Admiral A. C. Richmond for the Coast Guard and Don R. Berlin, president of the Helicopter Council of the Aircraft Industries Assn., for the manufacturers.

Zimmerman Award

Zimmerman is assistant chief of the stability research division at NACA's Langley Field Laboratory. He was awarded a patent for the flying platform concept in 1947, while employed by the Chance Vought Division of United Aircraft Corp.

At NACA in 1951 he joined with Paul R. Hill to extend the research using supersonic air jets to support the platform. The team proved that directional control could be achieved by shifting the body weight of a person standing on the platform in free flight.

Results of Zimmerman's work were published by NACA and the investigation continued into platforms supported by rotating wings. This led to further development by Hiller Helicopters and DeLackner under Navy and Army contracts.

Zimmerman is doing further research on the field of vertical-rising transports at Langley Field.

New AHS Officers

Washington—New officers of the American Helicopter Society elected last week at the 12th Annual Forum:

President: Charles M. Seibel, Cessna Aircraft Co.

Secretary: Rene H. Miller, Massachusetts Institute of Technology.

Treasurer: Col. Robert R. Williams, U. S. Army.

The following will serve as regional vice-presidents:

New England: Bruce A. Goodale, Doman Helicopters.

Middle East: H. Stever Trempe, Vertol Aircraft.

Western: Herbert F. Moselen, Hiller Helicopters.

Southeast: Comdr. William Knapp, USN.

Midwest: Marvin T. Marks, McDonnell Aircraft.

Southwest: Robert R. Wheelock, Bell Aircraft.

T58 Weighs 325 Lb., Develops 1,024 Shp.

Washington—A thrust-weight ratio of better than three-to-one is a major feature of General Electric's T58 turboshaft engine designed for helicopter power and officially announced here last week.

Military rating of the new engine is 1,024 shp. for an engine-plus-gearing weight of 325 lb. It is less than five feet long and 16 in. in diameter.

Specific fuel consumption at normal power is 0.69 lb./hr./hp.

A T58-powered helicopter would have 50% more endurance or 100% more payload than a piston-powered equivalent, GE states.

First application of the T58 will be



CHARLES H. ZIMMERMAN

dual installation in a Sikorsky S-58 flight test vehicle, normally powered with a Wright R1820-84 reciprocating powerplant rated at 1,525 shp.

The T58 is a free turbine design with a constant speed control on output rpm. to maintain a constant speed on the helicopter rotor. The position of the engine control determines the rotor rpm., and leaves the pilot with one less engine parameter to monitor.

The T58 has an axial-flow compressor, a straight-through annular combustion chamber and a single-stage axial-flow power turbine. The gas generator turbine, which absorbs the power required to drive the compressor, is a two-stage axial-flow type, directly coupled to the compressor.

Major design philosophies of the T58 free turbine engine were described in AVIATION WEEK last year (June 27, p. 28).

British Air Exports

London—Britain's aircraft industry established a new export record in the first quarter of 1956 by shipping some $39,480,000 worth of planes, engines and components overseas in the month of March.

This was about the same as for the whole of the first quarter of 1955 and almost identical with exports in the year 1946, which were valued at about $40,488,000.

The March figure brings the total so far this year to $82,040,000, or to an annual rate of about $327,600,000.

Australia with $16,240,000 was Britain's best customer in March. The United States was runner-up with $3,480,400. Of the remaining 28 major countries who bought British aeronautical products the next best customers were Sweden, France and New Zealand.

Army Will Double Procurement Of Guided Missiles in Fiscal 1957

By Evert Clark

Washington—The Army will double its procurement of guided missiles in Fiscal 1957. It also has ruthlessly eliminated some research and development projects and cut back others in order to "place greath added emphasis on guided missiles" and electronics equipment.

Lt Gen. James M. Gavin, Chief of Army Research and Development, told a House Appropriations Subcommittee that "a real revolution has taken place in Army research and development in Fiscal 1956."

Gavin said this shift in emphasis from conventional weapons will be carried over into Fiscal 1957 by making drastic cuts in research and development work where the proposed end items were deemed less essential to the success of our modern Army in combat."

Lt Gen. Carter B. Magruder, Deputy Chief of Staff for Logistics, told the subcommittee:

"We are putting our major emphasis into the program for guided missiles. Approximately 55% of this (procurement and production) budget is for this purpose."

The Army spent $400 million for guided missile procurement in Fiscal 1955 and estimated the figure at the same level in 1956—although it had obligated only $160 million of that by Dec. 31, 1955.

'Funds' Boost

In Fiscal 1957, however, the estimated missile procurement figure jumps to $809.5 million, plus a new $52 million classified project which apparently is in the guided missile field.

At the research and development end the Army obviously has made some major decisions with regard to missiles within the last few months. When President Eisenhower sent his Fiscal 1957 budget estimates to Congress late in January, it included an R&D request of $79 million for "guided missiles and related equipment" and $19 million for aircraft.

In hearings before the subcommittee, the Army said it now is asking for $113 million for missile R&D work—an increase of $34 million over the original budget request.

"To make this increase without increasing the overall budget, the Army cut back its aircraft R&D request by almost $6 million and decreased its requests on six more of the nine general R&D categories.

Gen. Gavin pointed out that, in the year since the last budget hearings were held, Army R&D has been further reorganized. A Director of Research and Development was established with a status of an Assistant Secretary of the Army to handle responsibilities and functions previously assigned to the Assistant Secretary for Logistics and R&D.

On the military staff side, R&D responsibilities were shifted from the Deputy Chief of Staff for Plans and Research to the Chief of Research and Development (Gen. Gavin) who was designated a Deputy Chief of Staff.

"This new structure recognizes the increasing importance of research and development and has added a great deal of stature to our research and development program," Gen. Gavin said. "It has improved our relations with scientific men and has put us in a position in the staff where I feel we can accomplish a great deal more for the Army than we ever have been able to in the past."

Rep. Robert L. F. Sikes (D., Fla.), subcommittee chairman, asked Gen. Gavin to supply a list of the Army's 12 primary R&D projects, "the cost of going into a crash program for each of those 12, the time to be saved, the advantages if any of having a crash program, and whether your department would recommend it. I would like to know also if a simple speedup would be advantageous for these 12 projects, the cost of such speedup and the advantages to be gained." Rep. Sikes also asked for a list of projects "which could best be deleted" if any. The Army later supplied these lists. They are classified.

Anti-Missile Missile Project

Testimony before the subcommittee also revealed that the Army thinks its Nike anti-aircraft missile system "has the growth potential to develop into the country's first anti-missile missile." Gen. Magruder said the version of Nike "now deployed operationally in this country can operate against supersonic targets" and the Fiscal 1957 budgets "will include a superior supersonic missile of the Nike type capable of destroying such targets."

Gen. Gavin pointed out that since the original Fiscal 1957 program was prepared "the Army, in collaboration with the Navy, has been assigned the responsibility for the development of Jupiter (the joint Army-Navy intermediate range ballistic missile). He made it clear, however, that this did not account for all of the increase in R&D missile funds.

Brig. Gen. Richard D. Meyer, of the office of the Deputy Chief of Staff for Logistics, said decreases in other procurement and production programs in Fiscal 1956—made in order to increase missile procurement—"provided for the earlier introduction of two items which represent bold advances in military capability, Jupiter and the Nike B program.

"The most significant increase in this area is caused by the completion of development of Nike B earlier than we had expected," he said. "This reprogramming will put this major improvement into the hands of our presently operationally anti-aircraft units a full year ahead of schedule."

News Digest

Hayes Aircraft received a $19,598,616 contract from USAF covering production modification, repair and spares for KB-50 three-point refueling tankers. Built for the Tactical Air Command, the KB-50s will each have three probe and drogue systems designed by Flight Refueling, Inc.

A new all-weather guidance system, called ATRAN, will be used in the Martin TM-61B Matador surface-to-surface missile (AW May 5, p. 37). Goodyear Aircraft Corp. has received a multi-million dollar contract for the system. Developed exclusively by Goodyear, it is housed in a self-contained nose package and requires no external control from a "mother plane" or ground stations. ATRAN may be an inertial or new type radar guidance system. It has been tested in firings at Holloman AFB, N. M., in a modified TM-61A missile.

Jet engine facilities expansion costing $7.7 million will be completed by the end of this year by Orenda Engines, Ltd., Toronto, Ont. additions will permit Orenda to conduct about 90% of engine tests in its own facilities at Malton and Nobel, near Parry Sound.

Six Douglas F4D Skyray carrier-based interceptors are flying with operational units of the Navy's Pacific and Atlantic fleets following completion of a fleet indoctrination program of more than 600 flight hours at Patuxent River Naval Air Test Center, Md.

General Electric J47-GE-25 engines now may operate up to 1,700 hr. before major overhaul. GE has produced more than 31,000 J47s, the -25 model powers the Boeing B-47 Stratojet.

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S-34 Quadradar landed many types of helicopters, faster and without interference with other air traffic, during U S Army's Operation Sagebrush.



CONSTELLATION Quadradar purchased by Northwest Orient Airlines daily lands aircraft at Shemya, Alaska under CAA certification.



F-84 Quadradar successfully controlled multiple approaches of F-84 jet fighters at England AFB, La., landing two in formation every 4 minutes.



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Bid for Airline-Fare Review Gains Force

General Accounting Office pushes recommendation before House subcommittee for fare-rate review.

Washington—Continuing pressure on the Civil Aeronautics Board to review its policies on airline fares and rates was stepped up last week when Comptroller General Joseph Campbell discussed with the House Anti-Trust Subcommittee the results of the General Accounting Office's investigation of the Board.

Campbell testified on major points in the GAO report, issued in April and repeated recommendations that the CAB conduct thorough reviews of its policies on rates, fares, routes, accounting procedures and subsidy offset.

Answering charges made during subcommittee hearings on the airline industry, Air Transport Assn. President Stuart G. Tipton said a general accusation of conspiracy heard by the congressional group is false.

Tipton said the accusation, made by North American Airlines, was particularly offensive coming from a combine which has evaded the obligations of the Civil Aeronautics Act and "governed its operations by the sole standard of maximum profit for itself."

ATA Reply

"What matters to our industry," Tipton said, "is not who enters the field but how entrance is to be granted and how operations are to be conducted. It is our view, as it has been the view of Congress, that the same set of rules should govern all aspirants and operators, that the American air is a public resource not a private asset to be surrendered to anyone for his own private gain and that the standards for the operation of scheduled air service are the standards which Congress has established—the public need, the public convenience and the public welfare.

Tipton told the House group that the U.S. scheduled airlines are the most useful, most efficient and by far the most competitive system in the world. He said the trunk airlines, "in moving from subsidy to self-support and from self-support to a re-equipment program which will revolutionize air service offer an outstanding example of how to provide airpower for free."

The ATA concentrated its testimony on four major points:

- The average air fare is declining and now stands at 1938 levels.
- Today's fare buys a service incomparably superior in quality and volume to that available in 1938.
- Growth in net earnings has lagged behind growth in usefulness, and a period of regulatory stability with sustained and adequate earnings, is needed to establish the industry as more than a speculative investment risk.
- Adequate earnings and regulatory stability are particularly important in the period ahead when the industry must meet the multi-billion dollar commitment many airlines have made for re-equipment.

GAO Study

Campbell concentrated his testimony on a few of the major recommendations made to the board in a General Accounting Office study of CAB operations. The GAO completed a two-year survey of the CAB last year. The study went to the CAB last November and was released publicly last month.

The GAO report advised the Board to conduct a thorough review of the passenger fare situation and come up with a definite policy as a guide in setting fares.

This recommendation has been echoed both by Chairman Emanuel Celler of the House Anti-Trust Subcommittee and by the House Appropriations Subcommittee which handled the CAB budget.

The CAB has approached a general fare investigation several times in the past, but something always has stopped it. Under the present system the CAB staff judges fares under a mixed set of standards culled from previous Board decisions and any other precedents available.

Investigation and Review

The most celebrated CAB approach to a fare investigation came in 1952 when the Board launched a review, then called it off a year later. The 1952 decision came when the airlines asked for a fare increase and elimination of the round-trip discount. The Board granted an increase of $1 per one-way fare and ordered a general investigation.

The decision was split. Members Oswald Ryan and Chan Gurney preferred to drop the round-trip discount as well as raise fares. Member Joseph P. Adams objected to the $1 increase. He did not think the Board should raise fares without any study or investigation of the claims of the carriers.

In the following spring, the airlines asked the Board to dismiss the case. Ryan and Gurney teamed with new member Harmar D. Denny to call the investigation off, substituting an informal staff investigation.

The majority said it called the inquiry off because a long-term view of earnings indicated they weren't unreasonable and because cost and traffic trends were uncertain, particularly in view of the undetermined effect of the Korean war.

CAB members Adams and Josh Lee strongly disagreed with the majority. Lee took the Board to task for failing to fulfill its statutory responsibility to conduct a full review of fares. He said the $1 increase granted a year earlier was an interim measure pending completion of an investigation.

Adams pointed out that three previous investigations had been dropped.

He stated:

"In view of the fact that passenger revenues have accounted for more than 82% of all revenues received by our trunklines in the last 14 years it seems incredible to me that we have not yet carried through an investigation into the principles upon which passenger rates have been sporadically raised and lowered and principles upon which the overall passenger fare level is justified."

CAB Fare Policy

Adams objected to the practice of adjusting fares without developing evidentiary records and said he thought the CAB was originally more interested in establishing principles of passenger fare construction than in reducing the fare level.

The GAO report also questions the wisdom of setting fares without the aid of a specific policy. The accounting agency said the CAB has spent considerable time investigating mail and freight revenues which amount to 15% of total revenues, but has never made a general investigation of passenger fares which have amounted to more than 80% of the total.

The GAO also said it has serious doubts whether the $1 increase was justified and that at any rate, fare adjustments should not be made without an overall study of the fare structure.

The agency's report advised CAB



Finnish Convair at Moscow

Finnish Airlines Convair 340 is parked on snow covered ramp before Moscow airport's terminal building Finnair's Convairs are the first American built airliners to visit Moscow on a regularly scheduled airline service Service was opened under trying conditions (AW Dec 12, p 21) Planes had to carry sufficient fuel for six hour round trip

to start a general fare investigation

Campbell supported this point of view before the subcommittee He said the staff investigation which followed cancellation of the general fare investigation resulted in a factual report which made no finding on the reasonableness of the fares

Campbell said the staff study wasn't the type contemplated by the Board in May 1953 and apparently was inadequate because of a lack of interest on the part of the Board

The Comptroller General said he has no idea whether the present fare level is reasonable and doesn't know what the Board would come up with as the result of an investigation

Pressure on the CAB for an investigation has been felt earlier from the same committee Chairman Celler severely criticized the Board for dismissing its investigation in 1953 and attempted to determine whether CAB member Donnalson's vote to dismiss it was the direct result of a visit from an ATA official

Further suggestions that a general fare investigation should be launched came during House appropriations hearings on the CAB budget Members of the subcommittee questioned whether fares might not be too high in view of currently substantial earnings enjoyed by the carriers They also were unhappy that the CAB had never established a single, guiding policy on fares

These pressures are in the direction of a more orthodox regulatory approach to the airlines Trying fares to a standard rate of return and other yardsticks would mean that the carriers would be regulated more in the manner the Interstate Commerce Commission regulates the railroads a technique that has raised bitter criticism from the rail carriers

Campbell also questioned the method of setting mail rates in relation to freight rates He said his agency feels that air mail should be carried at rates and yields closely related to freight rates and yields

The Comptroller General recommended that the CAB start a full scale continuing study of the domestic and international airline route patterns He said such a study could be the basis for formulation of a long range route development plan to provide for efficient expansion and promotion of air transportation

New DC-8 Purchase Announced by Delta

Delta Air Lines last week ordered two more DC 8s and arranged new bank credits totaling $30 million

The equipment order brings Delta's total turbojet order to eight DC-8s at a cost of $40 million The airline plans to buy more jet aircraft and is reportedly interested in the Convair Skylark

High Court Rebuffs N. American Airlines

Washington—North American Airlines received a major setback in its fight to keep its name last week when the Supreme Court refused to review another phase of the airline's involved name case"

The high court upheld a lower court ruling which granted North American Aviation, Inc, an injunction restraining the large irregular carrier from using the North American name

According to an airline spokesman, North American Airlines will ask the Supreme Court for reconsideration of the case Under Supreme Court rules the carrier has 25 days in which to ask for reconsideration for writs of certiorari

North American Aviation originally petitioned for an injunction against the North American group in August 1951 A U S District Court ruled in favor of the airframe manufacturer and the decision was later upheld by the U S Court of Appeals 9th District (AW Oct 10, 1955)

The Supreme Court decision follows another high court ruling which affirmed the authority of the Civil Aeronautics Board to make North American Airlines change its name because of a complaint by American Airlines American protested that North American's name was too similar to its own and should be dropped

The Supreme Court decided the CAB had acted within its jurisdiction and the case was sent back to the Court of Appeals to determine if the Board's decision was supported by the record in the case

Mackey's First F-27 Delivery October 1957

Fairchild Engine & Airplane Corp has made a definite decision to build the Fokker F-27 Friendship in this country and plans to deliver the first of the short haul transports to Mackey Airlines in October, 1957

Fairchild has taken up its option with Fokker Aircraft Co for immediate delivery of drawings and engineering data on the pressurized F 27, now being built by Fokker Netherlands

The planes will be built at Hagerstown, Md under a high production tooling program calling for five F 27s monthly at the start and quickly accelerating output to 10 a month according to Richard S Boutelle, president of Fairchild Engine & Airplane Corp

The F 27, which costs $540 000, will carry 44 passengers and cruise at 280 mph It will have a range of 2 250 miles and be equipped with two Rolls-Royce Model 506 Mark 511 Dart turboprop engines with 12-ft Rotol propellers

Orders and options for 18 F-27s already have been disclosed by Fairchild Mackey has ordered two and optioned two more, West Coast Airlines has ordered four and optioned four, Frontier Airlines has ordered two and optioned four

New Routes Proposed For Allegheny, LCA

Allegheny Airlines and Lake Central Airlines have been chosen by a CAB examiner to operate new services in the Great Lakes area

In his report on the Erie-Detroit Service Case, Examiner Barron Fredricks recommended that Allegheny be extended to Detroit and that Lake Central be awarded a new route from Youngstown, Ohio to Erie and Buffalo

Fredricks suggests that both carriers be allowed to operate the routes for a five year experimental period

The examiner favors Allegheny over three other local airlines to operate a new direct service between Erie and Detroit Mohawk Airlines, North Central Airlines and Lake Central Airlines also have asked for the new route

Allegheny was chosen because it would provide more new and direct single-plane service between Detroit and points on its system than any of the other carriers Also Fredricks finds that operation of the route by Allegheny will cost the government less than would any of the other three

The examiner finds that extension of Allegheny to Detroit will supply a strong western terminal and improve the efficiency of the airline's system

The choice of Lake Central to operate a new Youngstown-Erie-Buffalo route would provide a needed service between the points and will provide the carrier with a stronger eastern terminal, according to Fredricks

Aeroflot Starts Flights To Scandinavian Cities

Airline service between Moscow and Scandinavia was started by Aeroflot last week Scandinavian Airlines System will begin flights Wednesday with twin-engine Saab Scandias SAS will make four round trips weekly to Moscow—two from Copenhagen, one each from Stockholm and Oslo All flights are via Riga, Estonia SAS flights to Russia will connect with the airline's trans-atlantic and transpolar services New York to Moscow flight time will be about 24 hr Los Angeles-Moscow, about 30 hr

TWA, Braniff Report Salaries

Reports of officers and directors salaries as filed with the Civil Aeronautics Board for the following airlines

Trans World Airlines, Inc R S Damon president and director (deceased 1-4-56) $84 098 salary $29 224 bonus and indirect compensation (up $529), and $1 000 director's salary (up $100) Warren Lee Pierson chairman of the board and director $64 000 salary (down $8 150) $25 569 bonus and indirect compensation (down $10 316) and $600 director's salary (up $100) J A Collings, executive vice president $48 000 salary $10 588 bonus and indirect compensation (down $6 100), and $500 director's salary (up $100)

E O Cocke vice president-sales $34 910 salary (up $1 016) $14 307 bonus and indirect compensation (down $4 020) A V Lasile vice president-finance and treasurer and director $34 016 salary (up $1 016) $10 372 bonus and indirect compensation (up $2 037) and $1 000 director's salary (up $200) G L Gilmore vice president public relations $10 016 salary (up $1 016) $6 432 bonus and indirect compensation (up $916) J H Ormsbee (elected 2-1) vice president-passenger service $2 958 salary $478 bonus and indirect compensation) D W Harris, vice president industrial relations $21 016 salary (up $1 017) $6 767 bonus and indirect compensation (up $320) L H Clay vice president and secretary $24 916 salary (up $1 016) $7 071 bonus and indirect compensation (down $1 650)

M J Flodinec controller $24 016 salary (up $2 016) $6 409 bonus and indirect compensation (up $384) T K Taylor vice president $23 016 salary (up $1 016) $7 312 bonus and indirect compensation (up $1 211) J L Weller vice president $21 816 salary (up $1 017) $7 106 bonus and indirect compensation (up $1 223) Fred M Ayers director $600 salary (up $200) $140 bonus and indirect compensation (up $62) John E Birkworth director $400 salary (up $200) $140 bonus and indirect compensation (up $62) Palmer Bradley director $1 000 salary (up $100) $140 bonus and indirect compensation (up $62) Powell Crosley, Jr director $100 salary (down $200) $140 bonus and indirect compensation (up $62) Noah Dietrich director $800 salary (up $600) $140 bonus and indirect compensation (up $62) A H Eisenhower director $700 salary $140 bonus and indirect compensation (up $62) Oscar E Ehrambr director $800 salary (up $200) $140 bonus and indirect compensation (up $62) Sidney Maestre director $700 salary $140 bonus and indirect compensation (up $62) M F Monfrose (elected 1-13) director no salary and $104 bonus and indirect compensation Hiram Bloomer director $1 000 salary (up $400) $140 bonus and indirect compensation (up $62) Ben-Fleming Samel (elected 12-1) no salary $100 bonus and indirect compensation V D Simpson director $900 salary $140 bonus and indirect compensation (up $62) Thomas A Stark director $500 salary $140 bonus and indirect compensation (up $62) Loyd Wright director $900 salary (up $100) $140 bonus and indirect compensation (up $62)

Cindbourne Clarke Whiteside Wolff and Brophy legal counsel $410 575 (up $46 - 879) Haskins and Sells auditing services $54 170 (up $28 640) Airport Medical Center medical services $10 47 (up $0 981) Ammann and Whitney professional services $12 668 Ballon Barton Dursine and Osborn Inc advertising services $47 500 (up $14 500) Brinks Inc protective services $10 950 William J Burns International Detective Agency Inc guard services $22 763 Dinsker Neill and Houston legal services $1 888 Central Watch Service janitor services $11 512 Cravath Swaine and Moore services with Equitable Life on land purchase agreement 1954 $25 000

Harvard College Observatory solar eclipse research, $10 000 Lowell Observatory investigation atmosphere and solar eclipse research $11 600 Merrill Lynch Pierce, Fenner and Beane advisory and consultation services $25 000 Mayer Friedlich Spiess Tierney Brown and Platt retainer and professional services $11 365 Russell G Phillips sales promotions $12 000 Universal Agency advertising $47 567

Capital Airlines Inc. J H Carmichael president and director $32 000 salary) R G Lechlei vice president (resigned 2-16) $90 - 500 salary James W Austin vice president and director (elected 2-16) $90 - 500 salary James B. Franklin vice president $25 600 salary) Robert J Wilson vice president $24 475 salary Hayes Dever secretary $19 250 salary) Charles H. Marrihson chairman of the executive committee and director $36 500 salary

Adair Ulmer Murrihson Keal and Ashley legal corporate tax matters and route proceedings $60 000 Baxter O Neill and Houston legal services $16 064 Lybrand Ross Brothers and Montgomery certified public accountants $17 640 (up $5 310) Mayer Friedlirk Spelss and Tierney legal services $11 309

Braniff International Airways Inc Charles E Beard president and director $60 600 salary (up $26 260) $4 365 bonus and indirect compensation (up $1 963) J W Miller executive vice president and director $30 000 salary (up $7 896) $2 700 bonus and indirect compensation (up $557) R C Shrader vice president and director $18 000 salary (up $2 857) $1 215 bonus and indirect compensation (up $2271) C C Adams, vice president and secretary $20 000 salary (up $7 001) $2 116 bonus and indirect compensation (up $963) Rex K Brark vice president, $20 000 salary (up $5 520) $1 305 bonus and indirect compensation (up $3571) Malcolm Harrison vice president $18 000 salary (up $5 247), $1 210 bonus and indirect compensation (up $441) Walter Hrnsbri vice president $18 - 000 salary (up $4 750) $1 215 bonus and indirect compensation (up $231) R V Carleton vice president $30 000 salary (up $8 000) $2111 bonus and indirect compensation (up $3521) O W Crane treasurer $13 200 salary (up $1 726) $850 bonus and indirect compensation (up $230)

V A Kropff assistant vice president $12 600 salary (up $7601) $810 bonus and indirect compensation R L Barrier assistant treasurer $10 140 salary (up $900) $626 bonus and indirect compensation (up $671) F J Schirtzinger assistant treasurer $10 140 salary (up $900) $626 bonus and indirect compensation (up $671) Lloyd Eden assistant treasurer $10 140 salary (up $900) $626 bonus and indirect compensation (up $67) Nella Bowlware assistant secretary $4 500 salary (up $300) $220 bonus (up $74)

Fred Jones director $1 200 bonus and indirect compensation (down $200) G Buller director $1 000 bonus and indirect compensation (up $300) R J Whiteford director $800 bonus and indirect compensation R C Epply director $500 bonus and indirect compensation (down $200) C N Law director $1 000 bonus and indirect compensation (up $100) G D Murdoch director $1 400 bonus and indirect compensation W W Dinnilken director $1 200 bonus and indirect compensation (up $1 000) Milton McElvrey director $1 000 bonus and indirect

Whiteford Hart Carmody and Wilson legal counsel $60 000

Capital Viscount Service Extended to New Orleans

Washington—Capital Airlines has inaugurated the first Vickers Viscount service outside the Chicago Washington and Chicago New York markets with scheduled flights between New Orleans-New York and New Orleans Detroit The service represents the first step to take advantage of the removal of CAB operating restrictions



MIAMI OVERHAUL base is hub of Pan American's busy Latin American Division which flew over a million passengers last year.

PAA Plans Latin American Expansion

By Craig Lewis

Miami—Pan American World Airways Latin American Division nearing its thirtieth birthday, has parlayed an early start and an aggressive approach into a dominant position on the air lanes radiating from the United States to the nations further south.

The Latin American Division, oldest in the Pan American system, counts 1955 a highly successful year and plans to improve the record this year. Last year, the division carried one-million passengers for the first time in its history.

Like most other airlines LAD broke its own traffic records in 1955, flying 1,045,131 passengers and 61,100,607 pounds of cargo in and out of seven U. S. gateways and over its routes in Latin America. These figures mean traffic gains of 18% in passengers and 34% in cargo over 1954.

Trend Continues

Early traffic figures for 1956 indicate that the growth trend is continuing, and the division is stepping up its efforts to make even wider gains this year.

Right now, the Latin American Division operates as a practically independent airline within the Pan American system. Policy still comes from headquarters but the every day operations are run by Executive Vice President Wilbur L. Morrison and his staff from the sprawling Pan American installation at Miami.

For a long time, in fact, the history of Pan American was the history of the Latin American Division alone. PAA President Juan T. Trippe started Pan American Airways with a 90-mile route between Key West and Havana in October, 1927. Operations were extended into the Caribbean area, then beyond into South America.

PAA Bulwark

In 1929, Pan American teamed with W. R. Grace Co. to establish Pan American-Grace Airways. Since then, Panagra has operated the West Coast route to Buenos Aires and Montevideo while LAD has developed the East Coast route. Over the years, PAA organized other affiliates in various Central and South American countries. Political aspects of such arrangements have provided headaches for Pan American from time to time, and the carrier has gradually withdrawn its participation in the airlines although it still owns varying parts of 12 of them.

During this early period of rapid expansion PAA had to develop many of its own airways and landing facilities. There was competition from foreign airlines but it was scarcely noticeable when compared with the complex hodge podge of airline services operated in Latin America today.

Later in the 1930s Pan American stretched its operations across the Pacific and the Atlantic but the Latin American Division was the backbone of Pan American's operations for years. Only in the past year or two has growing transatlantic traffic put the Atlantic Division in contention for the number-one traffic position in the system.

Today, the Latin American Division is an airline which flies from New York, Miami, New Orleans, Houston, Brownsville, Los Angeles and San Francisco to 15 countries and numerous colonies in Central America, South America and the Caribbean.

Latin America affiliates of PAA are Panagra, Lloyd Aereo Boliviano, Panair do Brasil, Aerovias Nacionales de Colombia (Avianca), Cia. Mexicana de Aviacion (CMA), Aeronaves de Mexico, Aerovias Venezolanas (Avensa), Servicio Aero de Honduras (Sahsa), Lineas Aereas Costarricenses (Laesa), Lineas Aereas de Nicaragua (La Nica), Compania Panamena de Aviacion (Copa), Cia. Dominicana de Aviacion (CDA) and UMCA.

The Latin American Division competes for traffic in a complex web of airline services on routes south of the United States. Nearly all the countries in Latin America operate international airlines, and several major European carriers have extensive services in the area.

The market is served by a total of 47 airlines a fact which creates a highly competitive situation.

Equipment Race

Modern equipment is a key factor in competing for the business of the traveling public, and LAD will improve service with the introduction of the DC-7B on its routes this year.

Panagra started using DC-7Bs in 1955, and Braniff Airways takes delivery on its DC-7C order this year. All three compete for the long-haul traffic from the U. S. to such points as Rio de Janeiro, Sao Paulo and Buenos Aires.

The Latin American Division's DC-7Bs will come from the Atlantic Division as the DC-7C becomes available for use on the Atlantic. LAD expects to have seven of the new transports by the end of the year.

The LAD fleet also will add four DC-6Bs from the Pacific-Alaska Division this summer. The DC-6Bs will be replaced on Alaskan routes with Boeing Stratocruisers, and they will replace four Lockheed Constellations recently sold to Delta Air Lines.

All this switching is the exception rather than the rule with LAD, which normally operates its own fleet of transports. Currently, the division has five Convair 240s, four DC-6s, two DC-6As, 18 DC-6Bs and eight C-54 cargo transports. The Convairs and the Constellations sold to Delta, will be retired from the fleet this year.

Tourist Service

LAD uses 14 aircraft for tourist service. The four DC-6s are used in tourist configuration and the DC-6As are convertible to that use, and the carrier usually has approximately eight of its DC-6Bs in tourist service.

Pan American's Latin American operations are centered at the giant Miami overhaul base.

Set up in 1948 to concentrate PAA maintenance operations in one spot, the overhaul base has grown to include 1,445,000 square feet of covered work and storage space and 20 outdoor service positions.

Miami's mild climate permits extensive outdoor maintenance. LAD is expanding its facilities with an addition to one of its hangars and more ramp paving.

The base also handles maintenance work for PAA's Latin American affiliates flying into Miami.

The Latin American Division offers two kinds of service in both first class and tourist operations. First class passengers can fly either the standard service or the President Special, a luxury extra-fare service featuring sleeperette seats, special food service and extra cabin attendants.

The standard tourist service includes meals and cocktails are available for passengers who want them. A special tourist service is operated to San Juan, Puerto Rico. These flights are considered a domestic type of service, and a higher-seating density is used.

San Juan Route

The San Juan route has developed into a heavily traveled segment for Pan American and its competitors. LAD does about 30% of its annual business with this service.

The east coast route to South American points produces another 20% of LAD's traffic and the remaining 50% comes from Central American and Caribbean services. Business in the Caribbean area ran ahead of LAD's total traffic last year, showing a gain of about 25% in passenger miles.

The Latin American Division is planning and conducting promotional programs expected to produce traffic increases this year that will outstrip last year's substantial gains. At the same time it is laying the groundwork for the turbojet operations due in less than four years.

The airline is busy building the traffic base needed for high-density jet operations and at the same time launching plans for the start of service with DC-8s. PAA says it will be the first jet operator on Latin American routes.

Customs Drawback

One factor in passenger travel that becomes increasingly important as flying times shrink is the red tape involved in getting passengers through the customs procedures required by various nations.

PAA is working hard at cutting this red tape, as is the International Air Transport Assn.

Pan American is trying a new approach to customs procedures at Miami in cooperation with the U. S. Customs Service. On certain flights passengers meeting standards which apply to about 75% of the traffic are allowed to make an oral baggage declaration. If it works out the plan will be extended to other flights and other airlines.

A key factor in the development of air traffic, especially in the growing Caribbean area, is the availability of hotel space. LAD officials say the lack of hotel capacity is retarding air travel growth although some expansion is under way, notably in Puerto Rico and the Dominican Republic.

Latin American governments are being encouraged to increase their capacity for handling tourists and Pan American is trying to convince them they should promote tourism with campaigns like those European governments have used with marked success.

Jamaica and Nassau stand as ample evidence of the success of advertising vacation attractions. Both these British colonies go in heavily for promotion and they do the biggest tourist business in the area.

Excursion Fares

Traffic on the long-haul routes to South America is being pushed with numerous tours and the introduction of an excursion fare for group travel which is 30% less than standard first class and tourist rates.

An attempt also is being made to encourage a northward flow of vacation traffic with the promotion of U. S. tours for South Americans. In one move LAD is trying to persuade the increasing flow of passengers between South America and Europe to travel via the United States.

Vacationers in Puerto Rico will benefit from PAA's plan to introduce the family fare plan and an excursion fare on the route.

The 16-day excursion fare cuts 11% off first class round-trip fares between New York, Washington and Boston and San Juan.

One big problem in operating to Latin America is the seasonality of traffic. Peaks run from the end of December to March and during the summer months PAA is selling in-



Portland Will Build $3.5 Million Terminal

Construction starts this summer on the first stage of a $3.5 million terminal at Portland (Ore.) International Airport having 16 loading positions and capable of handling 1.3 million passengers annually. Final stage will take 34 planes and 3 million passengers yearly.

centive travel as a means of filling the spring and fall slumps in the traffic pattern

The incentive program encourages U. S. business to use airborne vacations in Latin America as sales prizes and other production incentives. Pan American carried several thousand incentive passengers last year and plans to substantially increase this off-season business in 1956.

LAD Cargo Flights

The Latin American Division ranks as one of the leading cargo carriers among the world's airlines. Last year, the airline flew 32,117,000 ton miles of cargo in Latin America—16,731,000 ton miles in all-cargo flights and 15,386,000 ton miles on combination services.

LAD is shooting for a 35% increase in this cargo business in 1956, and Vice President Morrison has predicted that someday, possibly within the next ten years, the airline will get more revenue from cargo than it will from passengers.

About half the LAD cargo traffic is carried in a fleet of eight C-54 cargo transports. Pan American is adding to the cargo fleet and expects to have 13 C-54s by the end of the year.

A major problem with cargo traffic is that most of it is southbound, except on routes between the continental U. S. and Puerto Rico which have a fairly even flow both ways. Efforts are being made to promote northbound traffic and balance the pattern. One market Pan American hopes to expand is the transportation of racehorses from Argentina to the north.

The recent certification of Riddle Airlines and American Air Export and Import Co. as north-south cargo carriers is considered a boon by Pan American. Both carriers are expected to develop substantial interline traffic for transportation out of Pan American's U. S. gateways to Latin America.

Cargo Trays Speed Airfreight Handling

Electrically operated trolleys, running on tracks from railway car to airfreighter loading door, have been adopted by Australian National Airways to speed handling of air cargo.

The 'cargon' system, first tested in New Zealand, involves bogie-mounted trolleys or 'transversers' each carrying two trays—the cargons—holding six tons of mixed cargo. Height of the cargons can be adjusted to match the height of an aircraft floor.

First use by ANA will be in handling traffic over the Bass Strait between the Australian mainland and Tasmania. The system reportedly makes possible the uff loading of six tons of cargo and the loading of six more within 20 minutes.

House Group Cuts CAA, CAB Budget Requests by $11.6 Million

Budgets for the coming fiscal year request by the Civil Aeronautics Administration and the Civil Aeronautics Board have been cut $11,650,000 by the House Appropriations Committee. The cuts include a $2.5 million reduction in the initial budget request for the CAA five-year federal airways plan.

The CAA already has published details of the five-year plan for which it is asking $40 million to launch (AW April 30 p. 26). The House Committee recommended that the appropriation be cut to $37.5 million for Fiscal 1957, the first year in the five-year program. At least part of this however, probably will be restored when the measure reaches the Senate.

The House Committee report also recommends that the CAA's operation and regulation budget be cut from the $128.5 million requested to $125 million and that the budget request for air navigation development be reduced from $2 million to $1.5 million.

The CAB budget estimate of $20 million for subsidy payments to airlines was reduced to $15 million, and the committee report advises the CAB to give local airlines priority. The report recommends $4,550,000 for administrative expenses, $150,000 less than the CAB requested.

The committee, however, praised CAB efforts to cut subsidy and called for continued efforts. Specifically the committee recommended comprehensive studies of subsidy requirements, fares and rates.

The CAA wants $40 million to start its five-year program. Total capital programmed by the CAA for its five-year plan is $246,192,000 and the agency says the plan represents the minimum program to handle safely the air traffic volume expected in 1960.

In his foreword to the Federal Airways Plan, Civil Aeronautics Administrator Charles J. Lowen points out that there is no quick or easy solution to the air traffic problem. He said:

"While the problem is acute it must not be permitted to become chronic, it does have a solution in the plan presented here a solution which is good to the extent that money is made available for it."

The Federal Airways Plan includes a substantial investment in new radar facilities. In the fiscal year 1957 the plan calls for 15 new airport surveillance radar units including 13 RAPCONS (Military Radar Approach Control), at a cost of $792,000. A total of 109 airport surveillance radars is planned by Fiscal 1961.

Long range radar for airways control is budgeted for $12,473,000 and 18 units in Fiscal 1957, bringing the total to 22 units. The plan calls for 73 long-range radars by 1961. The secondary radar program starts with 27 units and $2,011,000 in Fiscal 1957 and calls for a total of 162 units when the five-year program is completed.

Controversy over the short-range navigation system leaves its future indefinite but the plan bases its estimates on continued use of VOR/DME although no money for new DME installations is requested in Fiscal 1957. The plan calls for VOR 76 units at $6,352,000 for the next fiscal year and 881 units by Fiscal 1961. If Tacan replaces VOR/DME CAA says 814 Tacan units will be needed through Fiscal 1961.

Work on approach lighting will cost $2,130,000 in Fiscal 1957 and includes replacement of 23 old lighting systems and construction of four new systems, bringing the total to 112. The five-year plan calls for 198 systems.

ANDB Prefers Tacan

Washington—The Air Navigation Development Board apparently is prepared to recommend Tacan over VOR/DME as the common air navigation system for use in both civil and military aircraft.

During testimony before the House Appropriations Armed Services Subcommittee on behalf of the USAF's Fiscal 1957 budget requests Maj. Gen. Gordon A. Blake, Air Force director of communications-electronics, said an upcoming ANDB report "calls for the use of Tacan in the common system." He added:

"It calls for the modification of the civil DME's (those already installed to use the Tacan type techniques). In other words it sets us on the track of a common system."

Earlier Blake said: "In order to be perfectly clear on . . . wherein the competition between the two systems lies Tacan operates on the same frequency band as civil DME, and it is between civil DME and Tacan that we have the conflict which requires ultimate resolution."

Airline Income and Expenses—February 1956

	Passenger Revenue	Mail Revenue	Express Revenue	Freight Revenue	Subsidy	Total Operating Income	Total Operating Expenses	Net Operating Income (before taxes)
DOMESTIC TRUNK								
American	17,000,505	540,370	336,432	977,425		19,082,126	18,446,718	635,408
Braniff	3,057,850	68,003	44,399	78,118		3,317,868	3,239,087	78,781
Capital	3,310,337	88,564	68,939	78,292		3,601,929	4,331,821	−729,892
Colonial	465,943	7,350	3,015	13,318	35,828	532,542	596,872	−64,329
Continental	1,199,063	31,384	11,022	31,944	146,302	1,387,937	1,352,542	35,394
Delta	4,623,943	108,442	73,901	138,146		5,114,244	4,662,086	452,158
Eastern	17,300,668	353,226	152,261	210,012		18,443,246	15,121,709	3,321,537
National	5,202,804	97,498	28,623	119,214		5,670,620	4,222,156	1,448,464
Northeast	473,668	8,302	6,502	6,873	148,977	654,467	744,802	−90,335
Northwest	2,840,133	130,026	73,524	158,312		3,283,375	3,876,561	−593,186
Trans World	10,137,490	338,158	248,257	368,743		11,354,647	13,096,629	−1,741,982
United	14,636,695	701,058	352,090	652,344		16,593,618	17,470,016	−876,398
Western			527	2,546		12,289	674,264	−661,975
INTERNATIONAL								
American	415,409	14,783	87	51,888		499,802	397,821	101,981
Braniff	395,022	111,264		15,605		560,373	557,059	3,313
Caribbean Atlantic*								
Colonial	56,072	386		822	4,370	64,882	110,924	−46,042
Delta	373,229	5,684		14,723		403,162	388,142	15,020
Eastern	878,559	15,475		15,949		930,231	692,184	238,047
National	417,539	3,218	1,232	4,657		456,258	291,517	164,741
Northwest	848,565	468,699	5,725	323,588		1,653,443	1,784,237	−130,794
Pan American								
Alaska	202,000	14,000		50,000	110,000	464,000	560,000	−96,000
Atlantic	4,505,000	744,000		651,000	125,000	6,601,000	7,984,000	−1,383,000
Pacific	3,388,000	638,000		503,000	17,000	4,656,000	4,501,000	155,000
Latin America	4,900,000	250,000		784,000	491,000	6,777,000	6,939,000	−162,000
Panagra	1,200,268	74,598		114,444	179	1,580,584	1,443,367	137,216
Trans World	2,239,207	543,513		275,764		3,174,626	4,585,870	−1,411,244
United	783,133	31,929		10,692		834,354	834,408	−54
LOCAL SERVICE								
Allegheny	234,313	6,069	8,391	862	127,656	384,077	477,114	−93,037
Bonanza	125,488	2,853	1,565	2,658	77,955	219,247	236,762	−17,515
Central	67,276	1,623	1,507	2,275	175,699	251,472	253,952	−2,480
Frontier	287,000	186,343	3,232	15,786		497,468	469,683	27,785
Lake Central	80,190	2,944	5,543		116,472	204,488	213,528	−9,040
Mohawk	275,384	3,399	3,334	5,222	50,310	342,396	400,769	−58,373
North Central	287,362	12,902	16,046		133,152	553,018	549,386	3,632
Ozark	178,182	170,519	3,510			357,220	416,060	−58,839
Piedmont	228,328	7,764	4,006	3,543	161,585	486,670	570,810	−84,140
Southern	124,762	6,263	4,299		137,384	277,756	301,322	−23,566
Southwest*								
Trans Texas*								
West Coast	141,481	3,280	1,241	2,558	117,065	268,009	329,040	−61,030
HAWAIIAN								
Hawaiian	257,761	2,846		49,498	19,323	316,330	386,848	−70,218
Trans Pacific	105,705	752		4,660	4,006	113,296	157,350	−39,295
CARGO LINES								
Aerovias Sud Americana*								
Flying Tiger				707,749		681,178	943,592	−262,414
Slick				939,566		939,566	1,027,796	−88,229
Riddle*								
HELICOPTER								
New York Airways*								
Los Angeles Airways	6,507	11,532	7,747		51,424	85,449	84,356	1,092
Helicopter Air Service		36,445				37,624	37,485	138
ALASKAN								
Alaska Airlines	81,115	37,785	777	41,283	154,106	363,965	404,634	−40,669
Alaska Coast	30,192	8,525	4,106		25,186	73,486	93,086	−19,600
Byers Airways*								
Cordova*								
Ellis Air Lines	21,529	4,075		3,089	18,035	49,364	68,260	−18,895
Northern Consolidated	32,986	24,172	167	11,889	51,259	171,330	186,874	−15,544
Pacific Northern	223,797	37,236		52,262	129,840	459,822	609,728	−149,906
Reeve Aleutian*								
Wien Alaska	37,919	34,053		14,323	79,170	369,482	328,249	41,232

*Not available

Compiled by AVIATION WEEK from airline reports to the Civil Aeronautics Board

VICKERS LEADS THE WORLD IN SALE OF TURBO-PROP AIRLINERS



"Wherever the Viscount flies . . . traffic figures rise"

Vickers' pre-eminence in the field of turbo-prop airliners is securely rooted in the superiority of the Viscount. The world's first and only turbo-prop airliner in commercial service, the Viscount has demonstrated its power to make new traffic and speed records throughout the world. Passengers are exceptionally enthusiastic about the Viscount's freedom from noise and vibration, its luxurious comfort and the largest picture windows in any commercial aircraft. And airline operators have discovered that the Viscount's appeal to air travelers is paralleled by its unmatched economy and efficiency of operation.

Behind the Viscount stand the great name and service organization of the Vickers Group—internationally famous as makers of aircraft, ships, industrial machinery and precision equipment

304 VISCOUNTS SOLD WORLD-WIDE AS OF APRIL, 1956

VISCOUNT 700 SERIES

Capital Airlines
Trans Canada Air Lines
British European Airways
Air France
Aer Lingus
Trans Australia Airlines
Canadian Department of Transport
British West Indian Airways
Hunting Clan Air Transport
Bulle Air Transport
Iraqi Airways
Indian Airlines
Fred Olsen Airtransport
Misrair
Braathens S.A.F.E.
Central African Airways
Linea Aeropostal Venezolana
Pakistan Government
Hong Kong Airways
Union of Burma Airways
Iran Government
Italian Government
Compagnia Italiana de Aviazione
British Overseas Airways Corporation
Philippine Air Lines
Hughes Tool Company (U.S.A.)
United States Steel Corporation
Standard Oil (California)

VISCOUNT 800 SERIES

British European Airways
K.L.M.
Transair Ltd.
Continental Airlines
New Zealand National Airways
Air Austria
Aer Lingus
South African Airways

United States Representatives Christopher Clarkson, 10 Rockefeller Plaza, New York 20, N. Y.

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POWERED BY FOUR ROLLS-ROYCE DART ENGINES

VICKERS-ARMSTRONGS (AIRCRAFT) LTD. WEYBRIDGE ENGLAND • MEMBER COMPANY OF THE VICKERS GROUP

CAB ORDERS

(April 19-25)

GRANTED

Seaboard and Western Airlines permission to serve Nuremberg, Germany, through Nuremberg Aerodrome and Wiesbaden, Germany, through the Wiesbaden Air Base.

Allegheny Airlines authority to start serving Cape May, N. J., April 29 for the 1956 summer season.

Capital Airlines exemption authority to lease one DC-4 aircraft from Mackey Airlines.

West Coast Airlines authority to omit service at Pullman, Wash., Moscow, Idaho, on all flights arriving during the hours of darkness, providing Pullman-Moscow is served on at least two daily round-trip flights. The authority remains in effect until lighting facilities at Pullman Airport become adequate for night operation.

Allegheny Airlines a one-year extension of its authority to serve Oil City-Franklin, Clearfield-DuBois-Phillipsburg and Bellefonte-State College on one daily round-trip flight between Cleveland and Philadelphia and to serve Oil City-Franklin on one daily round-trip flight between Cleveland and New York.

Flying Tiger Line an exemption to perform three flights from Charlotte or Raleigh, N. C. to Keflavik, Iceland, pursuant to a contract with the J. A. Jones Construction Co.

Permission to intervene in the Great Lakes-Southeast Case to the County of Allegheny, Pa., the Mayor and City Council of Baltimore, and the Baltimore Assn. of Commerce, the Greater Baltimore Committee, Inc., the City of Cleveland and the Cleveland Chamber of Commerce, the Greensboro-High Point Airport Authority, the County Court of Harrison County, W. Va., the Clarksburg Chamber of Commerce, the Commonwealth of Kentucky, the Louisville and Jefferson County Air Board, the Lee County Chamber of Commerce, Fla., the City of Morgantown, W. Va., and the Morgantown Chamber of Commerce, the City of Orlando, Fla., and the Chamber of Commerce of Pittsburgh, Pa.

Permission to intervene in the Phoenix Service Case to the Chamber of Commerce of the City of Denver, the City of Winslow and the Winslow Chamber of Commerce.

APPROVED

Agreements involving Continental Air Lines, Central Air Lines and various other carriers relating to intercarrier arrangements.

ORDERED

Suspension of Braniff Airways' proposal to increase certain local first class fares extended to July 29, 1956, to allow added time for investigation.

Northern Consolidated Airlines' final mail rates set at the rates proposed by the Board in its show cause order for the period starting Feb. 3, 1956.

CAB order in the Phoenix Service Case amended to give the County of San Juan, N. M., permission to intervene.

DISMISSED

Flying Tiger Line's petition for reconsideration of CAB action denying a charter exemption at the request of the carrier.

DENIED

New York Airways' petition for reconsideration of CAB action reopening the carrier's final mail rates. A NYA motion to discontinue also was denied.

Sabena Delays Service

Sabena Belgian Airways has postponed inauguration of its Brussels-Paris helicopter service, scheduled to begin this August. The carrier's six Sikorsky S-55's have been sold to the French government. Two already are delivered and the other four will be turned over next year when Sabena receives its Sikorsky S-58s. The presently remaining four S-55s will take care of Sabena's current helicopter operation but not the new service.

Shortlines

► **British European Airways** has installed flight simulators for Viscount and Elizabethan aircraft.

► **California Eastern Aviation** has ordered three Lockheed L1049-H Super Constellations for delivery beginning in mid-1957. The company currently operates nine DC-4s under military contract.

► **Ethiopian Airlines'** passenger traffic grew 19% in 1955 to 30,618,000 passenger miles.

► **International Air Transport Assn.** clearing house transacted $366,140,000 in interline business last year, an increase of 27% over 1954.

► **Lufthansa German Airlines** carried 104,000 passengers on its North Atlantic and European services during its first year of operation.

► **Ozark Air Lines** carried 65,838 passengers in the first three months of 1956, an increase of 39% over passenger traffic for the same period last year.

► **Pan American World Airways** placed its transatlantic cargo traffic for the first quarter of 1956 at 2,014,269 lb., 261% gain over the same period of last year.

► **Philippine Air Lines** has ordered two Viscount 770D transports from Vickers-Armstrongs. The PAL order brings total Viscounts sales to 304 aircraft.

Western Air Lines Buys Nine Electras

Los Angeles—Western Air Lines has purchased nine Lockheed Electra turbojet transports as a part of a $48-million new equipment program. The fleet of turboprops with spares will cost approximately $19.5 million.

First deliveries are scheduled for 1959, the full fleet will be in service by the spring of 1960.

WAL bought Electras equipping itself with Lockheed airliners for the first time because it can get them into service at least nine months before United Air Lines will have DC-8s.

Purchase of pure jets does not figure in WAL's immediate equipment program, according to Western's president, Terrell C. Drinkwater.

WAL also will buy four more DC-6Bs in addition to 13 previously announced, bringing the airline's fleet of 66-passenger airliners to 23 in 1958.

With introduction of the new Electras, travel time between Los Angeles and San Francisco will be reduced nearly 30 minutes, more than a half hour between San Francisco and Portland, and about 1½ hr. between Los Angeles and Minneapolis.

WAL expects to purchase an additional $3.5 million worth of ground equipment and other fixed assets during the next three years.

Source of these expenditures will include $5 million from the sale of new debentures, $16 million from bank and insurance company loans, and the major portion of the balance from the sale of surplus aircraft.

Electra Backlog

Electras ordered by Western Air Lines bring the total backlog for Lockheed's new turbojet up to 126. Electra backlog is increased to $235 million.

Other carriers which have ordered Electras: American, Eastern, National, Braniff and KLM Royal Dutch Airlines.

Cornerstone Placed For New York Terminal

The cornerstone for New York International Airport's 52-million international arrival building, centerpiece for a new $60 million terminal city now under construction, was placed last Monday.

The building with two adjacent wings to be occupied by foreign airlines, is scheduled for opening in mid-1957. The airport handled 3.7 million passengers last year; expects to process 8.5 million in 1965.

A LINE OF 3000 PSI COMPRESSORS

DELIVERING FROM 1.8 TO 16 SCFM by STRATOS

Stratos compressors for high pressure pneumatic systems cover a wide range of rated volume delivery and applications

Models are available either as complete packages, or as basic compressors only Complete units include electric or hydraulic motors, interstage coolers, moisture separators and automatic controls Certain models can be ordered with or without controls, with provisions for a variety of drives—electric, hydraulic or turbine. For the basic units, controls and ancillary equipment such as pre-coolers and after-coolers can be provided to match the specific aircraft requirements

Installation of the packages is simple, requiring only four mounting bolts and connecting to the high pressure air lines and electric or hydraulic service of the aircraft Automatic controls, standard equipment on all compressor packages, provide a minimum pressure differential of 100 psi between shut-off and turn-on pressures. The allowable shut-off pressure range is 2950 to 3050 psig, and the allowable turn-on pressure range is 2700 to 2950 psig A relief valve prevents overpressurization

Light and compact, each compressor is designed to operate over a wide temperature range—from 65° to 165° F. Integral cooling fans are standard equipment on all units



Model PCM3

Model 7024



Model 607t-1



Model 7023

BASIC MODELS

PCM3 **Delivery—from 7 to 16 SCFM**
Nominal rating—11.2 SCFM @ 15 PSI inlet
No fall-off with altitude when pressurization is available
Controls and moisture separator available
Suitable for electric, hydraulic or turbine drive
Weight 21 lbs without motor

7023 **Delivery—2.4 SCFM**
Complete package including controls, moisture separator and 400 cycle motor
Weight complete 33⅛ lbs.

7049 **Delivery—2.4 SCFM**
Complete package including controls and moisture separator
Constant speed 3 gpm hydraulic motor operates on 2200 to 3000 psig
When operating under 80° F, full rated output is maintained from sea level to 10,000 ft.
Weight complete 30 lbs

7024 **Delivery—2 SCFM**
Complete package including controls, moisture separator and 400 cycle motor
When operating under 80° F, full rated output is maintained from sea level to 10,000 ft.
Weight complete 33⅛ lbs.

7038 **Delivery—2 SCFM**
Controls not included—can be provided as a separate package • Hydraulic motor drive
Inlet can be pressurized • Weight 11 lbs

607t-1 **Delivery—1.8 SCFM**
Complete package including controls moisture separator and DC motor.
Weight complete 37¾ lbs.

7038 **Delivery—1.8 SCFM**
Complete package including controls and moisture separator
Constant speed 3 gpm hydraulic motor operates on 2200 to 3000 psig
Weight complete 29⅛ lbs

7024 **(available soon) Delivery—1.8 SCFM**
A simplified 3-stage compressor with 400 cycle motor
Incorporates pressure regulator.
Other controls available

For more complete data on Stratos' compressors write to: Stratos' Western Branch 1800 Rosecrans Ave., Manhattan Beach, Calif.

Stratos Western Branch also makes:

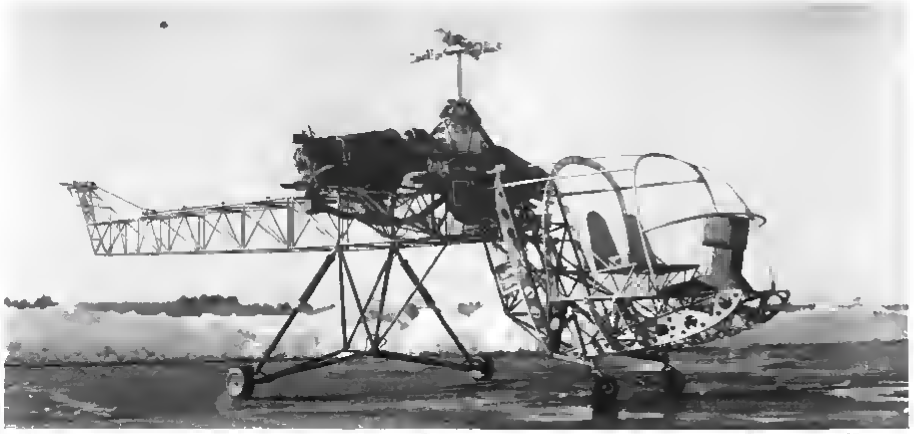
ACTUATORS • SOLENOIDS • EJECTORS • CONTROLS • BLOWERS

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A DIVISION OF FAIRCHILD ENGINE & AIRPLANE CORPORATION

Main Plant: Bay Shore, L. I., N. Y. • Western Branch: 1800 Rosecrans Ave., Manhattan Beach, Calif.

West Coast Office: 1355 Westwood Blvd., Los Angeles, Calif.



OMEGA SB-12 HELICOPTER PROTOTYPE will fly this spring. Designer's objective was reduction in complexity, ease in maintenance.

Omega Helicopter Designed to Cut Cost

By Russell Hawkes

New Bedford, Mass.—Omega Aircraft Co. has designed a new aircraft it hopes to introduce as the "Model A Ford" of the helicopter industry, cutting down cost and complexity.

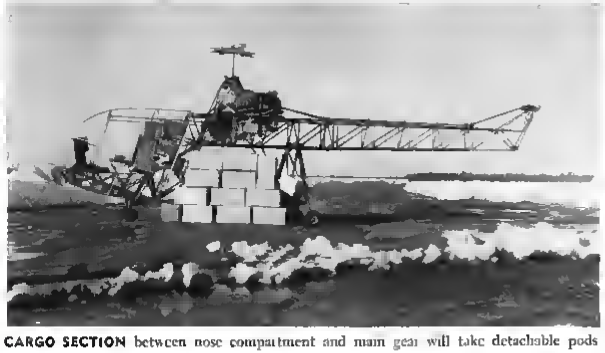
The aircraft, known as the Omega SB-12 is scheduled to fly for the first time sometime this spring. It was designed by Bernard Szwcer, president and chief designer of Omega, and a small group of backers and co-workers.

All the detailed production drawings for the prototype, a twin-engined, single-rotor aircraft, were made on a minimum-budget basis.

The firm plans to reorganize for production of the SB-12 on the basis of market response to the new design.

The objective of Szwcer's design philosophy are ease of maintenance and rehibility. He hopes to get these qualities by sacrificing the best imaginable payload-to-weight ratio in favor of strong simple components and by sacrificing the lowest possible production cost in favor of high-quality, high cost prodnetion methods. The gross weight and the total cost have been kept low by minimizing the number of parts.

The design philosophy included the idea that maintenance must be performed in an inflexible environment of rigid time limits and the geometric diameter of each operation. Therefore, the number of operations and the time required for each were cut to eliminate any tendency to do a hurried job. To prevent space limitations from hurting the quality of maintenance work, a low density design was evolved with space between units and each unit performing only one function.



CARGO SECTION between nose compartment and main gear will take detachable pods.

Units Divided

The design of major complex units in the SB-12 is broken down into simple, easily replaceable components. Each one is easily accessible for inspection and repair and the initial total cost is low because of the reduced number of complicated castings, forgings and machined parts. The total number of machined parts in the SB-12 is only about 500.

Stock and interchangeable parts have been used wherever possible. Of the 19 bearings in the helicopter, 17 are automotive stock parts. The remaining two are specialized swashplate bearings.

The welded tubular fuselage design was chosen because it can be repaired in the field without special jigs or fixtures and production is relatively inexpensive.

Its manufacturers regard the SB-12 primarily as a light, flying crane for short haul operations, although its range will not differ much from that of competitive helicopters.

The zig-zag fuselage design provides a cargo bay between the enclosed nose section and the main landing gear. Cargo can be carried in detachable pods or nets slung from the fuselage structure. This system would result in easier, quicker loading and, consequently, a shorter turnaround time. A pod could be equipped with accommodations for four passengers.

Twin-Engine Reliability

The twin-engined SB-12 will be most useful where the danger and cost of a complete power failure are too great to justify the risk of single engine operations. Helicopter feeder lines have been forbidden to operate in some heavily-populated cities for this reason.

The two uncowled Franklin engines of the SB-12 have independent fuel and oil systems so that the failure of one system cannot shut down both engines. The engines are mounted on tubular outriggers swept back 15 degrees. The sweep shifts the center of gravity aft to permit heavier loads to be carried in the nose section and reduces firing impulse vibrations which reach a maximum when the crankshafts are parallel. It also provides a slight ram feed for the cooling fans in cruising flight.

Power is carried to the transmission by a centrifugal clutch on each engine which engages at an engine speed of 1,350 rpm. The clutches are shoe-and-drum types in which the shoes serve as flyweights centripetally loaded by flat springs.

A constant velocity universal on the load side of each clutch isolates bending moments generated by engine travel and minimizes vibratory stresses in the drive system.

Ratchet Disengages

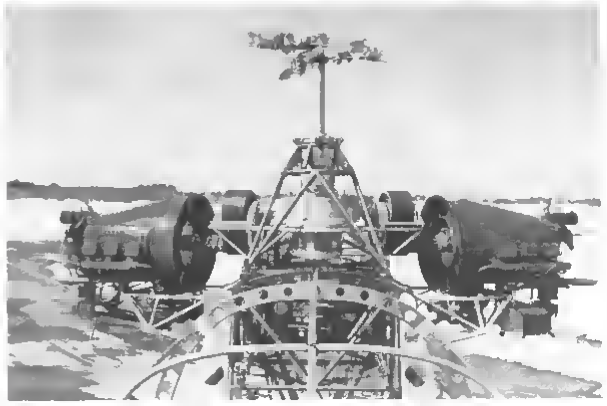
Should one engine fail or lose power, it is separated from the transmission by a jaw clutch disengaging unit (ratchet). If the slow engine is brought up to the speed of the operating engine, the jaw clutch re-engages.

The first speed reduction in the drive system from each engine is provided by a belt drive unit with a ratio of 1 to 1.8. The load side shaft is offset approximately 10 inches above the power side shaft. A turnbuckle between the two can be adjusted to take up any stretch due to wear.

The 13 belt units also are important as vibration absorbers. During the three firing impulses which take place every two engine revolutions, the maximum torque jumps to 11,000 inch pounds from a mean torque of 4,000 inch pounds. Gear trains would transmit these impulse loads at much higher amplitudes.

The belts are especially designed by Goodyear for helicopter use.

Constant awareness of the vibration problem has resulted in what is probably the lowest engine-vibration level



TWIN FRANKLIN ENGINES sweep aft 15 deg. to reduce firing impulse vibration.



TWO 2-BLADE rotors are splined to shaft.



OMEGA TRANSMISSION is heavyweight.



ROTOR NUBS' parts are interchangeable. Complete overhaul takes five hours.



Contour-Weld tubing used for an annealing furnace application. Photo courtesy of Westinghouse Furnace Division, Meadville, Pennsylvania

new **CONTOUR-WELD**

stainless tubing

takes bends like these in stride...

Here's dramatic proof of the soundness of the weld in Trent's new *Contour-Weld** pipe and tubing. Bent on an extreme 3¼" center line radius, this 3" O.D. x .083 wall sample shows no evidence of failure in the weld area — even though the weld is on the outside of the bend. It's just one example of what you can do with new *Contour-Weld*.

If your application calls for bent pipe or tubing, you can use *Contour-Weld* with confidence. You'll like its uniformity in wall thickness and curvature . . . its corrosion resistance . . . its superior performance. Try *Contour-Weld* stainless pipe or tubing on your next job—you can't buy better.

Bending done by Jehenn Tube Bending Company, Milwaukee, Wisconsin

*Contour Weld is the trade mark of the Trent Tube Company for its process of welding pipe and tubing which is protected under U. S. Patent 2,716,692

TRENTWELD **STAINLESS STEEL TUBING**

TRENT TUBE COMPANY, GENERAL SALES OFFICES, EAST TROY, WISCONSIN (Subsidiary of CRUCIBLE STEEL COMPANY OF AMERICA)

of any conventional helicopter yet built. What the vibration level will be after the rotors have been installed remains to be seen. Sznycer emphasizes that he is prepared to scrap the rotor configuration now contemplated if the level is too high.

Simple, Heavy Transmission

The rotor shaft is turned by a simple gear-and-pinion transmission. The two engine pinions and the tail rotor pinion are interchangeable. The tail rotor pinion, being more lightly loaded, could be built more lightly, but the present plan was adopted to minimize the number of specialized parts and to increase reliability.

To use the simple gear-and-pinion arrangement instead of the more-common and more-complicated planetary drive system it was necessary to sacrifice a high reduction ratio. The low-reduction ratio requires that rotor speed and disk loading both be high, which results in lower cruising speeds and less than optimum hovering characteristics. Sznycer feels that the gains in reliability, simplicity and low maintenance costs more than offset the sacrifice.

The transmission case is made up of an upper half and a lower half joined by studs and nuts. Each half is a simple casting having a single separation line. Both rotor gear journals are bored to the same diameter in a single operation by joining the two halves before machining. This reduces the cost of production and assures proper alignment. The transmission weighs about twice as much as the transmissions of comparable helicopters now on the market because component shapes are kept simple to minimize production operations and insure strength and reliability.

Lubrication

Transmission lubrication is provided by a force-fed dry sump system which moves oil at the rate of three gallons per minute. The oil in the transmission case is pressurized to 165 psi to prevent foaming. A wet sump system was rejected despite its lower weight because the churning of the oil by the gears would cause it to foam and overheat. Overhaul of the transmission under field conditions is expected to require only 1.4 man-hours.

The transmission is isolated from bending forces acting through the rotor shaft by a flexible Oldham coupling. It is protected from thrust loads by a splined connection to the rotor shaft directly above the Oldham coupling.

The four bladed main rotor is actually comprised of two identical two bladed rotors splined to the same shaft one above the other and 90 degrees apart. The simple hubs have completely interchangeable parts. Sznycer claims it is

USAF Tests Beech Dart Tow Target



DURING SERVICE TRIALS Beech Dart tow target is cradled, waiting snatch pickup by



F-86H SABRE, which swoops over standards supporting target towline, then carries

DART TARGET ALOFT for practice firing mission during trials at Wendover AFB, Utah





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Built to hold their precision indefinitely, these aircraft bearings are recommended wherever superior quality and high speed operation are required. For some applications, a special alloy steel—developed jointly by Bower and several aircraft companies—is used.

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BOWER ROLLER BEARINGS

cheaper to produce and easier to maintain than any other hub now in production. Complete overhaul of the hub will require less than five man-hours under field conditions. In a demonstration for AVIATION WEEK company crews disassembled and reassembled all the hinges and bearings of a single blade unit in three minutes using nothing but standard hand tools and an arbor press.

Sznycer claims aerodynamic advantages for the location of one pair of rotor blades above the other. By setting the pitch of the upper blades one-half degree flatter than that of the lower blades, he says that partial-power descents can be made with somewhat less danger from vertical pulsations caused by unbalanced downwash.

Engineers Propose Shortage Solutions

Los Angeles—A panel of experts affected by the shortage of engineers in their capacities as chief engineers, managers and educators have proposed long- and short-term solutions at a recent meeting here.

Moderator for the panel was L. C. Craigie (Lt. Gen., USAF, ret.) who held engineering positions in the service and now is vice president engineering for Thiokol Inc. Speakers were Edgar Schmued, chief engineer, Northrop Aircraft; Carlos Wood, chief engineer, Douglas Long Beach Div.; Frederick Lindvall, chairman, Engineering Division, California Institute of Technology; William Rogers, assistant general manager, Aerojet-General Corp.; and Dr. C. J. Bickmeier, vice president, Lear Inc. and general manager, LearCal Division.

All agreed that:

- **Greater utilization** must be made of today's available engineering talent.
- **There are short-term,** stopgap measures which should be taken now.
- **The real solution** lies in starting now to generate an interest in high schools and even primary schools in engineering as a career, leading students to take the difficult courses which lead to a science or engineering degree.

In his opening statement, Craigie said he was not sure just what methods for pushing engineering talent on common problems and similar projects as was done in World War II of urging a cold war should be the same as those of a hot war. He called for a better understanding of the engineer's problems. He put part of the blame for today's situation on talk during the late 1940s which said there were more engineers being graduated than could possibly be used.

Other speakers and their salient points:

- **Edgar Schmued**—There is too much

Pan American to use SKYDROL in first U. S. jet liners



Typical flight times for both the Douglas DC-8 and the Boeing Intercontinental will be New York-London in 6 hours 15 minutes...Tokyo-Seattle in 8 hours, 32 minutes.

Pan American's mammoth order for 25 Douglas and 20 Boeing commercial jets is the largest aircraft order ever placed by a private company . . . the first firm purchase of jets ever made by a U. S. airline. And Pan American recognizes that the jet age is also an age of high-performing synthetic lubricants. The company has specified fire-resistant Skydrol fluids to be used in the hydraulic systems of both types of aircraft.

Skydrol fluids offer safety, higher lubricity than petroleum fluids, which means longer pump life, less maintenance and greater operating economy. Whatever your hydraulic fluid needs, there's a Skydrol "tailored" for the job—in jets as well as piston engine aircraft! For more information, write Organic Chemicals Division, MONSANTO CHEMICAL COMPANY, Dept. SKD-8, St. Louis 1, Missouri.

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34 MAJOR AIR CARRIERS NOW USING SKYDROL

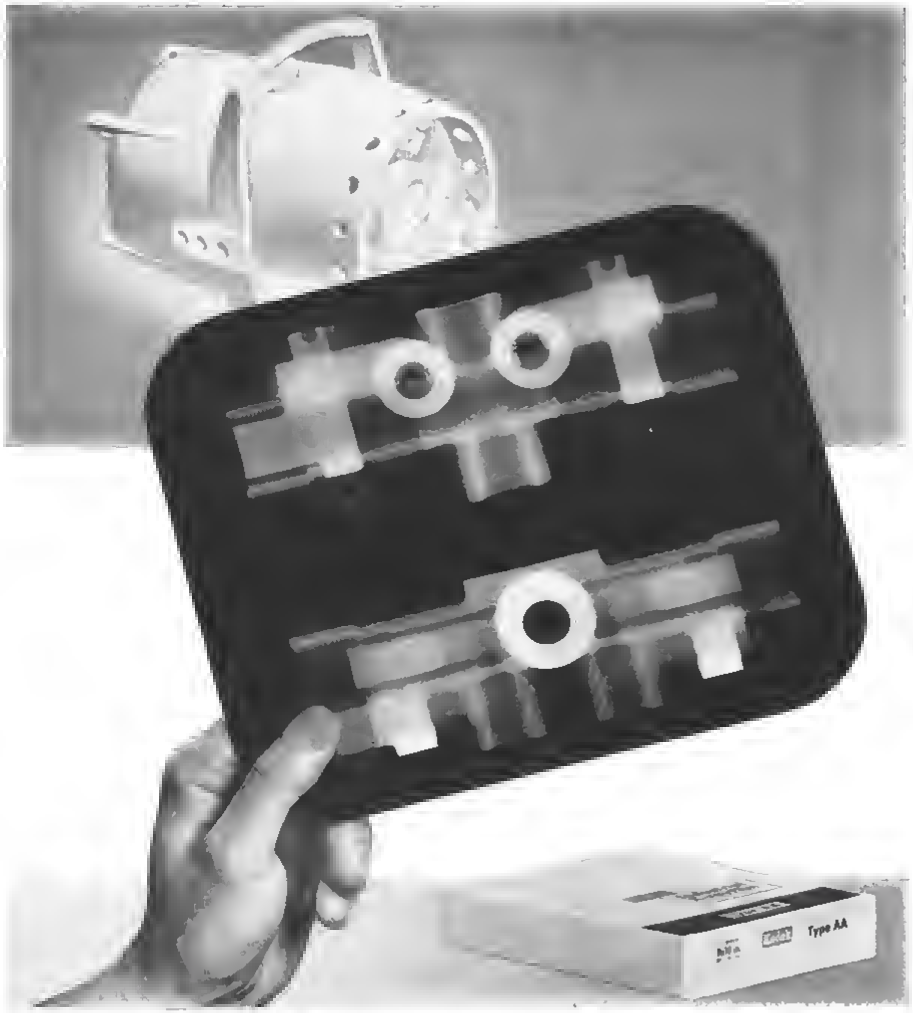
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FLYING TIGER	ALITALIA	LAI
PAN AMERICAN	SWISSAIR	ANA
CANADIAN PACIFIC	UNITED	ARAMCO
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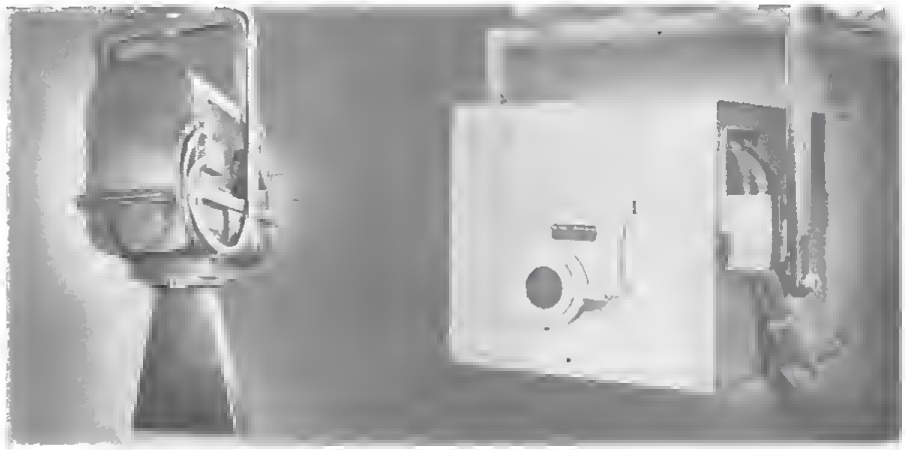
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Read what the new Kodak Industrial X-ray Film, Type AA, will do for you

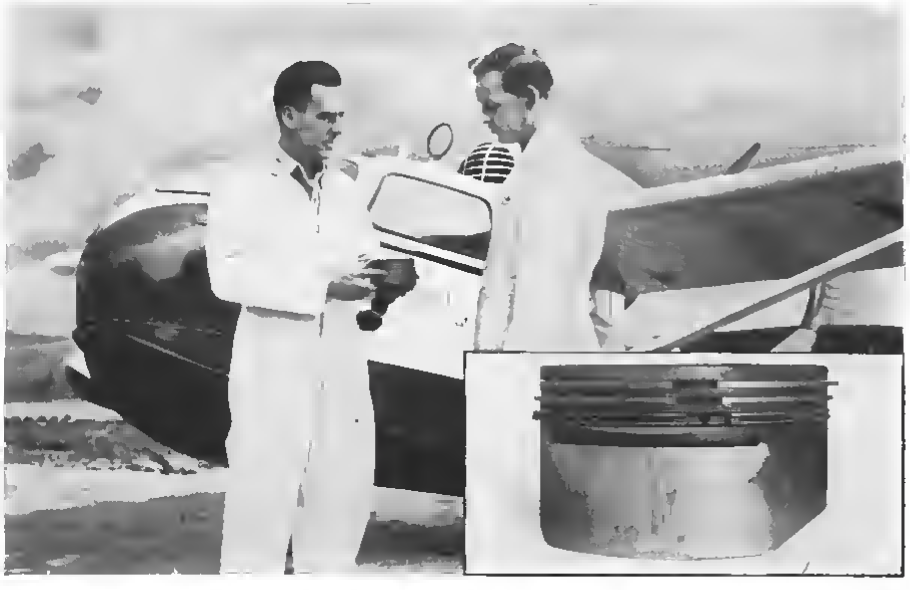
- Reduces exposure time—speeds up routine examinations.
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PLANE FAX

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"Here's how we get 1000 safe hours between majors"

In spite of flying under much tougher conditions than most light planes ever meet the amphibians and float planes of Commodore Air Service Sausalito California, consistently get 1000 hours between overhauls. Owner Bob Law explains:

"Our engines stay in top condition right up to overhaul time because we keep them perfectly tuned and use only RPM Aviation Oil Compounded. The photo shows how clean 'RPM' keeps pistons and rings — oil drain holes stay completely clear. It holds down oil consumption, too. We don't add oil all day even making as many as 50 full power take offs from water in 12 hours of sightseeing flights. And bearings stay in top shape good enough to put back in place if we wanted to. 'RPM' really does a job for us. We wouldn't use anything else."

Both "RPM" Compounded and "RPM" *Uncompounded* are available from your Standard Airport Dealer. "RPM" Uncompounded is made from the same selected oil stocks is extremely stable, holds wear to very low levels. For pilots who demand uncompounded oil of unexcelled quality.



TIP OF THE MONTH

It's wise to telephone or deliver your flight plans, rather than radio them in. Keep the air to ground channels clear for emergencies — the emergency may be yours.

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duplication of effort between companies. One short term solution is to interest engineers in other fields (architects, automotive, civil), in pursuing aeronautical careers. Emphasize that engineering can lead to management careers since it is possible that with the increasing part technology plays in the national economy, some day all top management people will have to have technical training. The military services should recognize the price of finding and hiring engineers today as reasonable costs in contracts.

• **Fredrick Landvall**—Better teaching quality is needed, but good teachers are good engineers and follow the trend of the saving in industry today. "One meets the nicest money." The most difficult things to teach undergraduate and graduate students are fundamentals. There is a need for better teaching of these to produce engineers who think more broadly, more creatively.

Make possible parallel paths of financial and professional progress, so that a good engineer can advance as an engineer and not have to become an administrator.

• **Carlos Wood**—Three suggested ways for conservation of today's available talent:

1. Mechanization, using machines and non-engineering talent where possible.

2. Communication, to the engineer, of what his job really is and between various engineering fields to eliminate the current problem of the same term having different meanings in different specialties. Get someone else to write the engineer's reports.

3. Keep a mutual respect existing between scientist engineer and shop man, leading to better morale in all sections of the pipeline from idea to hardware. Today's inter-field attitudes leave much to be desired.

• **William Rogers**—How industry management can help.

Today's grants and fellowships allow to schools are not enough and should be increased. Assist today's engineering and science students with summer jobs and educational loans. Use company engineers to teach school at night and in off hours as part of a student work study plan whereby students work in the plant by day, study at night. (Aerojet uses this system.)

Help regular teachers with summer work (which broadens their training, boosts their financial standing and renews their interest in their work), since teachers are the key to quality and quantity of future engineers. Produce documentary films and other informational aids, pitched toward formative years students, which glamorize the life and work of an engineer.

• **Dr. Breitwieser**—Engineering output could be upped 10% by employing factory production methods.

Four rules for getting more out of engineers:

1. Make time and machine (computers) load studies, with analysis on a factory-production slant.

2. Spend more money on materials and save engineering man-hours. When a project looks bad, kill it. Use the engineering man-hours required to save the old project to create a new one.

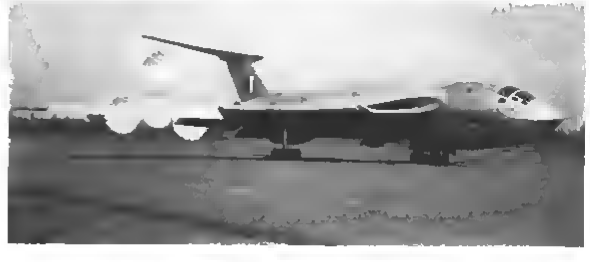
3. Engineers need a re-infusion of gadgeteering" blood. Put a gadgeteer to work along side the engineer to translate his ideas into articles quickly. There is a need for more "dirty-hand" engineering.

4. Break engineering departments into smaller units, make "big" business into "small." Increase the professional standing of the engineers by conveying the idea that "you're in business for yourself" regarding their ability to capitalize on their ideas.



Victor Bomber Droops Wing Leading Edges

Handley Page Victor heavy bombers take off and land with outboard leading edges of wings drooped as well as flaps lowered. The British strategic bomber, powered by four Armstrong Siddeley Sapphire jet engines, also requires four drag chutes (right) on landing. This bomber is subsonic and has an altitude capability in excess of 50,000 ft.





Bendix-Pacific has developed a line of high performance Air Motors which have been completely qualified for generating hydraulic and electric power in missiles

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The motors are qualified for applications over an ambient range of 20° to 160°F and accelerations of 60G. They have been operated with inlet gas temperatures over 1000°F. The motors which have a basic weight of 1½ pounds, are available with or without governors.

Sales engineers are available to discuss in detail your potential requirements.

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Cooperative Tunnel Now Makes Mach 1.8

Pasadena—The modernized Southern California Cooperative wind tunnel was dedicated here recently to mark completion of a modification program which boosted the facility from subsonic to Mach 1.8 supersonic capability.

The modernized tunnel, which has a test section of 8 ft. 6 in. by 11 ft. 3 in. is owned jointly by Douglas, Convair, Lockheed, North American and McDonnell. California Institute of Technology operates it on a non-profit basis under the direction of Dr. Clark B. Millikan.

The new facility uses three quickly interchangeable test sections, or carts, each of which can be fitted into the tunnel on tracks for testing under a wide variety of speed and model conditions. One of the carts is a conventional solid wall subsonic test section, the second is a ventilated transonic throat for Mach numbers up to 1.3, while the third cart is a flexible nozzle throat for speeds up to Mach 1.8.

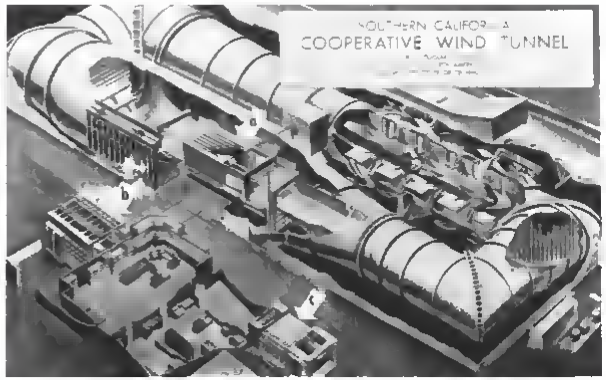
Surrounding the test region is a pressure airlock. Closing of large gate valves across the flow channel at either end of this airlock permits access to the test model under sea level conditions regardless of tunnel pressure.

The tunnel began operation as a subsonic facility (Mach .95) back in 1945. Among aircraft whose development has been initiated or advanced in the facility are North American's F-86 and F-100, Lockheed's F-80, F-94 and F-104, McDonnell's F-101, Douglas' DC-6, X-3 and DC-8, Convair's F-102 and B-58 and Boeing's B-47 and B-52. Missile models which have been tested in the tunnel include Corporal, Honest John, Nike, Navaho, Sparrow and Hermes.

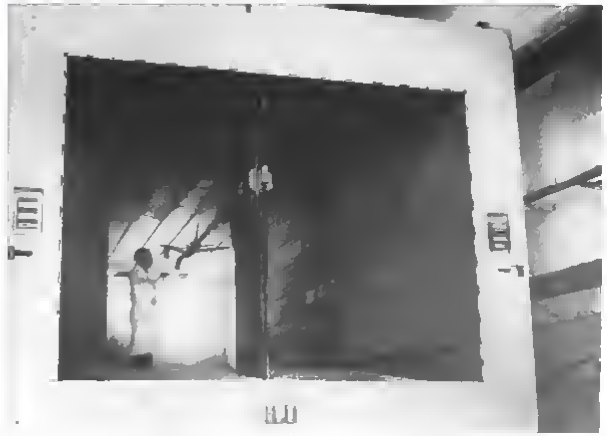
Air for the tunnel is driven by four 16-bladed controllable pitch fans. Total power input of 40,000 hp. is supplied by two synchronous electric motors, turning two fans each.

Gruen Makes Gyro Test Equipment for Atlas

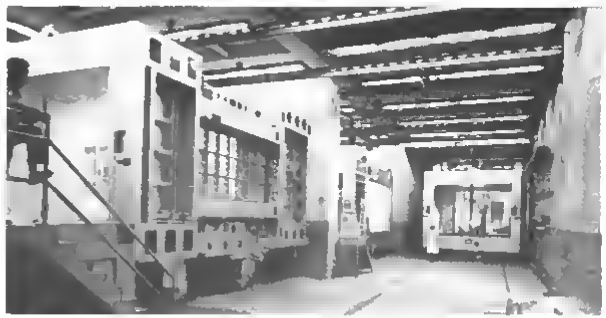
Gyro test equipment for pre-testing Convair Atlas intercontinental ballistic missile systems and supersonic aircraft instrumentation is included among contracts totaling $2,239,000 awarded Gruen Watch Co., Cincinnati, Ohio. Former contract is worth over $1.3 million, the latter $200,000. Both are new fields for Gruen. Other contracts include frequency meters for U.S. Army Signal Corps ($565,000) and oscilloscopes for Navy's Bureau of Ships ($174,000).



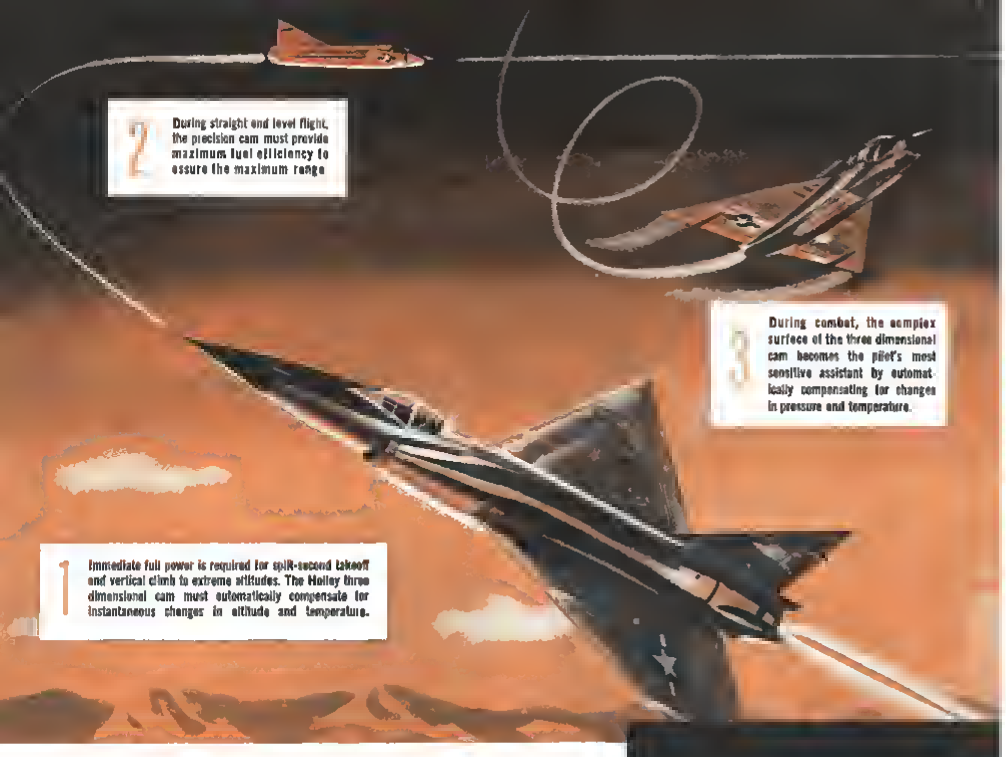
TRANSONIC CART (A), with supersonic (B) and subsonic (C) carts readied for tests.



MODEL is mounted on sting in supersonic cart, can be adjusted during test



CARTS in individual docks enable setup of tests for high volume tunnel utilization.



How the Holley three dimensional cam functions as an automatic co-pilot

The job of the Holley Power Control for jet aircraft is to sensitively control engine power according to the pilot's requirements and, at the same time, make automatic adjustments for split-second variations in altitude, pressure and temperature. The "brain center" of advanced Holley controls is a three dimensional cam which is so contoured that it can adapt itself to all combinations of atmospheric temperature and pressure, from Thule to the Equator and from sea level to extreme altitudes.

In addition to the automatic compensations made for the pilot by the three dimensional cam, it interprets the pilot's request for changes in power. It's the most important link between cockpit and engine.

The three dimensional cam, like the power control itself, is designed, engineered and manufactured by Holley—one of the world's foremost power control manufacturers.



Typical "brain center" of a Holley aircraft engine control. Note the delicate machined surfaces. Each plays a vital role in mechanically regulating the engine under varying conditions.

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A-23

Steerable Chute's 'Ears' and Slit May Improve Jumping Accuracy



Trenton-Robbinsville Airport—A new steerable parachute which propels itself forward at about eight mph has been demonstrated recently by Jacques Andre Istel of Air Associates, Inc.

The canopy, made by Pioneer Parachute Co., Inc. and called the Pioneer Steerable Parachute, incorporates two features:

- A pair of ears which scoop air out of the canopy and direct it backward through vents to give the chute its forward motion.
- A slit in the back of the canopy which allows the jumper to steer right or left by pulling on one or the other of a pair of shroud lines.

Because of the forward motion and steerable features of the parachute, a jumper can pin-point a landing with considerable accuracy, provided the air is almost still.

Pioneer used a basic 35 ft. nominal diameter paratrooper canopy to which it added the ears and slit. The chute has an area of 160 square yards and has an average sinking rate of about 15 ft./sec. This compares with an area of 91 square yards and a sinking rate of 22 ft./sec. for the standard 28 ft. diameter chute used so extensively during the last war.

Istel's jump was made in the only existing Pioneer Steerable Parachute at the time. He said its steering qualities were excellent.

National Parachute Jumpers and Riggers, Inc., of whom Istel is vice president in charge of training, will send a five-man team to Moscow to participate in the World's Parachuting Championship to be held there from July 15 to 30. Half the points will be awarded for spot landing on a target, the other half for proficiency in "sky diving," a sport well known in Europe but practically unheard of in this country. Istel, possibly the country's only trained sky diver, defines the sport as "the technique of maintaining absolute control of one's body during free fall before opening the parachute." He gave a demonstration of sky diving by falling free under perfect control for the first 2,000 ft. of his 3,500 ft. jump with the steerable parachute.

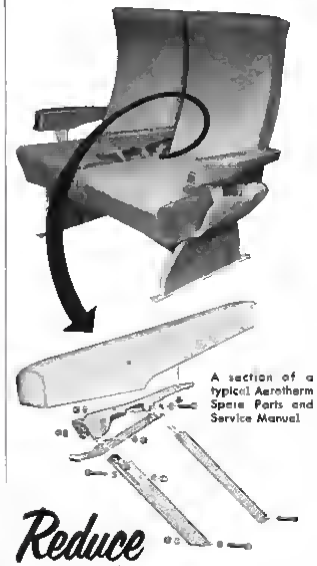
Pioneer is contributing a total of five steerable chutes to help the U. S. team at Moscow this summer.

Harvill Casts Missile Parts in Magnesium, Aluminum

Magnesium and aluminum die castings for parts of Navy Terrier missile will be made by Harvill Corp., Los Angeles, Calif., under contracts from Motorola Research Laboratories, Phoenix, Ariz., and Convair-Pomona, Calif. First phase of the joint contract runs until 1957.

AEROTHERM

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A section of a typical Aerotherm Spare Parts and Service Manual

Reduce

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Uniformity of parts simplifies inventory and cuts maintenance costs.

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EXHAUSTIVE TESTS on the General Electric T58 turboshaft engine have been conducted to prove its basic design and to assure top performance and reliability. Results show that the advanced design features of the T58 promise vastly improved helicopter performance.

GENERAL ELECTRIC

Tests on G.E.'s New T58 Engine Point to Major Advance in Helicopter Flight

General Electric's T58 turboshaft engine, now on test for the U S Navy Bureau of Aeronautics, represents a significant step forward in the art of small aircraft gas turbine design.

Incorporating many advanced engine-design features, the T58 introduces to the 1000-horsepower class a turboshaft engine with **low specific fuel consumption** and an **outstanding power-to-weight ratio**—advantages that truly forecast greater helicopter and fixed-wing aircraft performance.

The T58 also introduces a new concept in **constant-speed control** that provides a standard of operation unapproached till now. Designed to take full advantage of a free power turbine, this new control permits operation of the helicopter's rotor at its maximum efficiency and eliminates the need for speed adjustment by the pilot during normal helicopter operation.

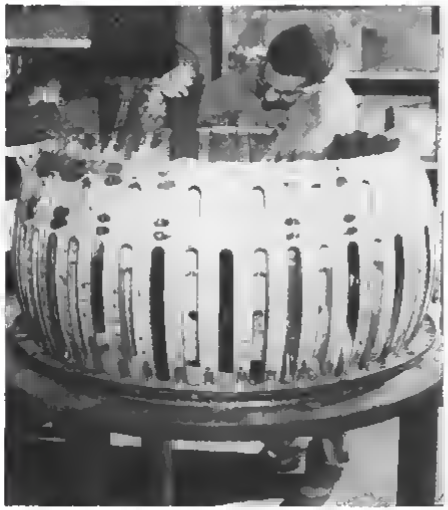
These are only a few of the features that make the T58 the ideal helicopter powerplant and another example of General Electric's ability to design and build for tomorrow's aviation needs. With fifteen years of experience in producing aircraft gas turbines of the highest reliability and quality, G E continues to set such standards as proof of its role in the progress of American aviation. Section 233-1, General Electric Co., Schenectady 5, N. Y.

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GENERAL ELECTRIC



SHROUD PIERCING operation for J57 compressor.



AFTERRURNER variable nozzle assembly for J57.

Solar Diversifies to Strengthen Future

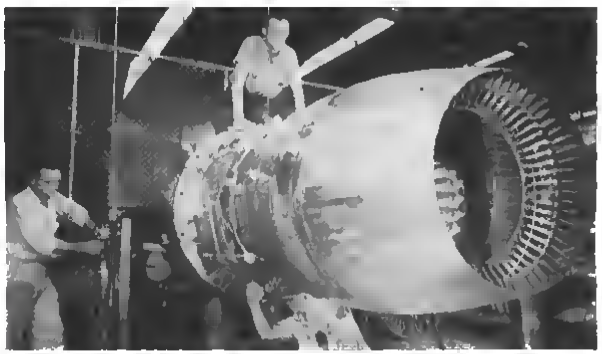
By Irving Stone

San Diego—The management of Solar Aircraft Co is seeking to strengthen the company's future position in the aviation field by increased activity in research and development, proprietary articles and subcontracting.

Largest proportion of Solar's current backlog is represented by engine components which are being fabricated for every major jet engine builder.

Other segments of the company's business include:

- **All-metal brazed honeycomb structures.** Applications of this fabricated material include possible uses in ballistic missiles to help solve the re-entry problem.
- **Microjet control.** This is a novel pneumatic unit for regulating engines.
- **Auxiliary power units.** Solar makes the Jupiter and Mars gas turbine auxiliaries, both company proprietary articles.



EXPERIMENTAL titanium alloy variable nozzle shroud was fabricated for Allison J71.

Brazed Honeycombs

Big portion of Solar's work with all-metal honeycomb sandwich presently is directed toward solving production problems with this relatively new material. It is developing new braze alloys, new methods and techniques for sandwich structure assembly. The company also is experimenting with sandwich construction using very thin sheets of stainless, titanium and super alloys.

To prepare for anticipated requirements, Solar has established a new all-metal honeycomb sandwich manufacturing department complete with all necessary equipment for volume production.

It is now producing a number of all-metal sandwich parts for an advanced jet engine. It also has made prototype all-metal honeycomb sandwich missile fins, engine shrouds and other components.

Solar research engineers are investigating the potential application of all-metal brazed honeycomb structure in connection with the solution of the re-entry temperature problem associated with future ballistic missiles.

The company has made modified forms of stainless steel honeycomb structure for evaluation of transpiration cooling characteristics.

Solar also sees the possibility of using all-metal honeycomb as a supporting structure for refractory materials for insulation against extreme heat in high speed missile and aircraft flight.

Missile Fabrication

In the missile field, one of Solar's most recent projects was the developmental fabrication of a huge stainless-steel shell for a high priority missile program. Shell was made from .018 to .025 material and was assembled in sections by roll welding. More than 1,000 ft of roll welding was involved. Testing revealed no weld failures or leaks.

In its Des Moines, Iowa, plant Solar is fabricating the shell for the Hughes Falcon air-to-air missile. The shell is comprised of magnesium skin and rings. Solar has been engaged on the Falcon project for more than a year.

The company also is engaged in fabricating propulsion unit components for Aerojet-General, Lockheed, and North American Aviation's Rocketdyne Division, in support of Douglas, Lockheed, North American and Convair missile projects.

Microjet Control

One of Solar's most promising proprietary articles is its Microjet control, a novel pneumatic device for regulating various engine functions. U S and British engine manufacturers are showing keen interest in the device and it is currently being evaluated for a number of engine applications.

- **Pratt & Whitney** is currently testing the Microjet as a variable nozzle control on an advanced version of the J57 turbojet.
- **Wright Aeronautical** is adapting the Microjet for ignition and fuel control on the XRJ-47 ramjet engine.
- **General Electric** is studying the Microjet as a control on a nuclear propulsion engine.
- **Bristol Aeroplane Co Ltd's** Engine Division has procured a complete Microjet afterburner control system for use in an advanced version of the Olympus.
- **Rolls-Royce** also is testing the Microjet control for afterburner applications on its engines.

Feature of the control is its ability to operate without cooling under extreme environmental temperatures encountered in high speed flight. The Microjet unit is being offered by Solar in stainless steel makeup to meet these operational conditions. It has been successfully operated at temperatures in excess of 1,000F in Solar's laboratories.

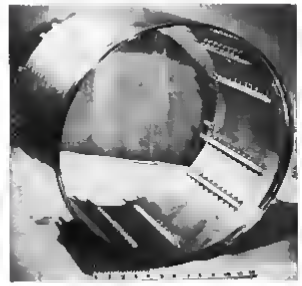
The Microjet control, in a typical application, uses a small amount of compressor bleed air to establish a reference pressure and compares this pressure to some pressure level in the engine. On the basis of this comparison it transmits a proportional signal which is used to operate an actuator, throttle or valve.

Jupiter and Mars

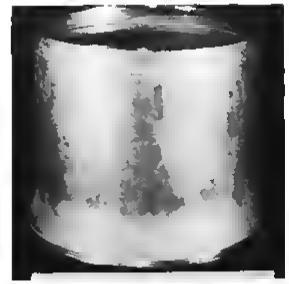
In the gas turbine field Solar manufactures two basic auxiliary power units—the Jupiter and the Mars—both company proprietary articles.

With the Jupiter, Solar is moving from the development to the production stage with a gas turbine compressor version turning out 250 air hp for starting large jet engines. Negotiations are underway with the Air Force for production quantities of the Jupiter for starting the B-66's turbojets.

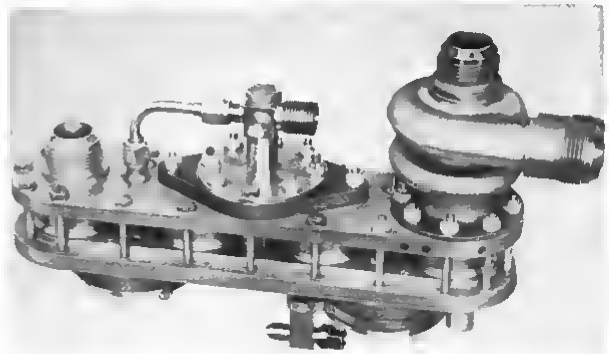
Solar has delivered more than 350 of the 50 hp Mars airborne auxiliary electrical power units for use in the Douglas C-124C, Lockheed C-121C, Boeing KC-97 and the Convair C-131B flying electronic test bed.



AFTERRURNER COMPONENT, a brazed honeycomb sandwich, is designed for 1,500F.



JET ENGINE CASING, an all-metal honeycomb sandwich, uses Type 321 stainless steel.



DEVELOPMENT MODEL of Microjet variable nozzle control for advanced version of J57.

Engine components Solar is building for the industry represent the largest proportion of the company's backlog. Parts are being fabricated for every major jet engine builder.

On the J79 Solar has been working with General Electric through the development stage of the engine on sheet metal components, and will continue as a major subcontractor to GE as the engine enters the full production phase. Solar also is building components for advanced GE turbojets.

For the Pratt & Whitney J57 Solar is fabricating the front and rear compressor cases, compressor vanes and shrouds, diffuser, combustion chamber housing and afterburner.

Major sheet metal components are also being built for the J75 for both Pratt & Whitney and Ford.

At the company's Des Moines plant components are being built for advanced Pratt & Whitney jets.

On an advanced Wright Aeronautical ramjet engine, Solar is building the exhaust duct and valve assembly and the diffuser. Also fabricated for Wright



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Photoelectric Tracking Systems For many years Kollsman has specialized in high precision tracking systems.

Periscopic Sextants for manual celestial observations.

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proven components now in production

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Pressure Switches — actuated by static pressure, differential pressure, rate of change of static pressure, rate of climb or descent, etc

Motors — miniature, special purpose, including new designs with integral gear heads

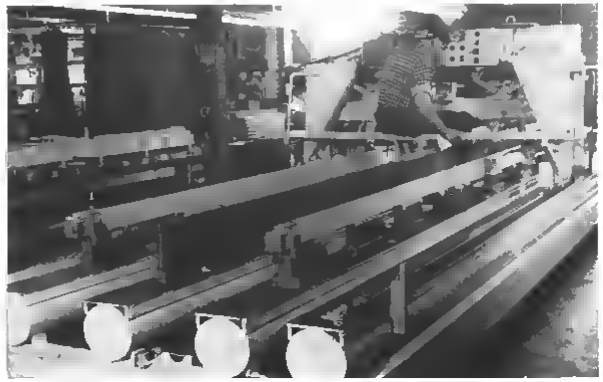
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optical and electromechanical for flight test observations.

Please write us concerning your specific requirements in the field of missile or aircraft control and guidance. Technical bulletins are available on most of the devices mentioned.

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Wooden Blades and Iron Tools

Sitka spruce spars for helicopter rotor blades are shaped two at a time at Kaman Aircraft Corp Suffield, Conn., shop. The spars are composed of 3 in laminated Sitka spruce with four laminations of rock maple at the front. The completed blade, composed of the spar, trailing edge spruce ribs and outer skin of ⅛-in plywood, is covered with linen fabric The leading edge is capped with stainless steel, bonded to the wood spar. Photo above shows two spars being shaped by four Stanley Electric Co routers, one on each side of each spar. A master spar (center) guides a ball-following device which makes the routers cut to exact contours

is a major portion of the sheet metal components for the J65

For the Allison J71, Solar is building components such as the aft frame and the afterburner Parts also are being fabricated for the Allison T56 turboprop Work on the Allison engines is being done at Solar's Des Moines plant where prototype manufacturing also is being done for advanced Allison engines

In the airframe subcontracting field Solar is concentrating on stainless-steel structures At present, major airframe production is on stainless nacelles for Lockheed's P2V Neptune and the 1649 Super Constellation Also being built for the 1649 are stainless steel main landing gear doors, panels and access doors, nacelle fairings and aft structures

Solar has shipped more than 1,000 nacelles for the P2V with production running as high as 44 per month

First deliveries of nacelles for the 1649 were made recently

Production Training

On the-job training for 73,927 production personnel cost Boeing Airplane Co more than $3 million last year More than 70 courses were provided involving 1,356,428 man-hours in addition 352,600 man hours were taken by employes in voluntary off-hour periods at vocational schools in Seattle and Wichita Supervisory personnel received 158,000 man hours of management schooling

'Need-to-Know' Airport Crash Alert

A crash alarm system which, in five seconds alerts all necessary departments but keeps the emergency secret from the public, is in operation at San Francisco International Airport

The system is put into operation by the tower operator who presses a button on a special microphone This causes alarm bells to ring in the fire house and other appropriate places Simultaneously, the fire house doors are automatically raised

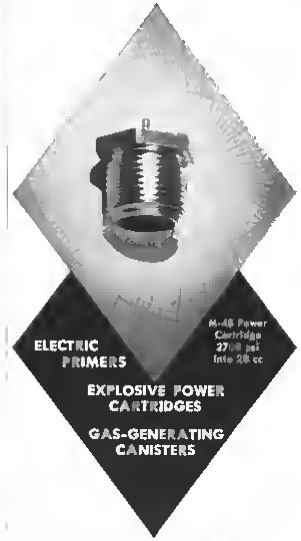
When five seconds are up, the tower operator announces over a closed circuit public address system, only to those persons concerned the nature of the emergency and its exact location

Efficiency of the system is indicated by a recent minor emergency Most of the airport's emergency equipment arrived at the airplane involved in two minutes or less, although some of the vehicles had to travel over a mile to reach the scene

Stores Ejection System For Supersonic Jets

Los Angeles—Pastushin Aviation Corp has received an Air Force contract for research and development of a two-gun, 30-in ejector rack designed primarily for ejection of 450-gal fuel

SQUIB SPECIALISTS



An organization specializing in the design, development, and manufacture of explosive ordnance, McCormick Selph places first emphasis on dependability The entire group is located in a 60,000-sq ft plant on a 200 acre site having perhaps the most complete facilities of its kind in existence.

Your procurement and reliability problems in specialized explosives can probably be solved at McCormick Selph — either with standard items, tried and proved, or with units produced to meet your specific need

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CASE HISTORY 1

REQUIRED:
A dependable supply of this small, machined electrode to meet customer's quality and quantity needs at reduced cost.

NASSALL SOLUTION:
Hassall-designed re-heading process, involving no critical dimension changes, resulted in a 50% cost reduction to customer.

CASE HISTORY 106

REQUIRED:
Replacement for stud with insufficient head to act as step for automatic hemming.

HASSALL SOLUTION:
Substitution of Hassall cold-headed cotter pell with annular threads for greater holding power. Substantial cost savings.

CASE HISTORY 64

REQUIRED:
An economical method of manufacturing perforating punches out of hard materials such as drill rod.

HASSALL SOLUTION:
The Hassall cold-heading process plus engineering skill overcame the difficulties presented by these alloys at considerable savings.

CASE HISTORY 37

REQUIRED:
Bumper bolt with bonded rubber cap for license plate support.

HASSALL SOLUTION:
The large head on this bolt would ordinarily call for screw machining but the two lugs under the head ruled this out. Progressive cold-heading was Hassall's answer.

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SAVINGS
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SMALL PARTS
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Multiply these case histories a thousandfold and you'll get some idea of the variety of tough problems we crack, and the savings we effect for our customers in the course of a year.

Our cold-heading process—supplemented by secondary operations—imposes amazingly few limitations on the parts and fasteners we can make. Don't forget that we are not limited to "stock" sizes. These illustrations show that Hassall—a specialty supplier—can show you substantial savings, better deliveries and no-charge assistance at all times.

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AND OTHER COLD-HEADED
FASTENERS AND SPECIALTIES

tanks or 4,000 lb bombs. Current Pastushin production ejector is 14-inches one gun.

The new model's two guns will make possible compensation for shifting centers of gravity in external stores as well as being more efficient at supersonic speeds, and in critical flight attitudes. An electric timing circuit for bombs is provided.

A special 25-ft tower will be added to Pastushin research facilities from which simulated stores will be ejected and air loads studied simultaneously.

Qantas Gets New Flight Simulators

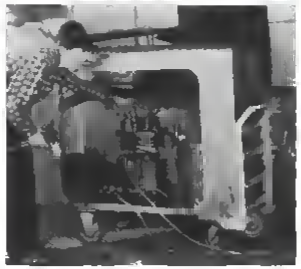
A new English flight training machine, called the Redifon Flight Semi-simulator, is being acquired by the Australian airline, Qantas Empire Airways, Ltd., to train Super Constellation flight crews.

The device, similar to U.S. made simulators, will duplicate everything from tire squeal on touch down control stick loads to any type of emergency including engine (or engines) out, fire, electrical, hydraulic or fuel system failures.

The semi-simulator will be installed at Mascot International Airport, Sidney, early next year.

Boeing KC-135 Preflight

Preflight areas at Renton (Wash.) Municipal Airport will be extensively modified to accommodate the first Boeing KC-135 Stratotanker jet transport in August. Construction will include blast fences, fuel storage and small buildings for shops, crews and offices.



Fast Painter

Hot paint, airless spray unit allows Glenn L. Martin painters to coat a B-57 twin-jet bomber one-third faster than with a conventional air spray gun. Unit heats paint to 165F, sprays it under 600 psi pressure and atomizes the paint at the spray nozzle to insure a smooth, high-gloss finish, according to Martin. Only two hot-paint coats are needed instead of three conventional coats.



ON COURSE—Unceasingly, Northrop directs its progress toward development and production of the most effective weapons for national defense. Notable achievements by Northrop include Scorpion F-89 interceptors, unmanned, far-ranging Snark SM-62 A-bomb carriers, and Radioplane Company's pilotless drones and missiles. New horizons in a multitude of fields are continuously scanned by Northrop engineers and scientists, years in advance of charted goals. Working in close coordination is the well-balanced Northrop production force, thus insuring efficient, economical output. Already, the course is set by Northrop for new weapons of tomorrow, their successful production and prompt delivery assured by this coordinated effort.

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It Lays *Railroad Tracks* in the Sky!

Here for the first time are the releasable facts concerning ATRAN—the amazing all weather navigator which unerringly pilots planes and missiles to far off landmarks as though geared to railroad tracks built in the sky!

This is not a story of a pre-set "robot." Nor does it concern the type of device—commonly misnamed a "mechanical brain"—which does the bidding of dials set by human hands prior to being sent on its mission.

For ATRAN has proved it literally can do everything a contact pilot can do, including thinking and reasoning—*and then some.*

It can follow an exact course to a distant ground location THROUGH ANY TYPE OF WEATHER—day or night—mile after mile—time after time—with the accuracy of a locomotive racing over steel rails firmly set in a roadbed in the sky.

In short, ATRAN possesses the eyes, brains and muscle of the first truly "thinking" guidance for a missile or aircraft in this era of fantastic scientific progress.

Conceived, engineered and proved—it is a pioneer development of Goodyear Aircraft Corporation.

At present ATRAN is "under wraps"—a contribution to our national security.

Sometime in the future it will "bore holes through the sky" as it opens up new and safer airlanes for long distance commercial aircraft—flying schedules over the most isolated areas—*with complete all weather navigational accuracy to destination.*

ATRAN is a major advancement by Goodyear Aircraft to meet the needs of an uneasy Present—a significant advancement with a brilliant peacetime Future!

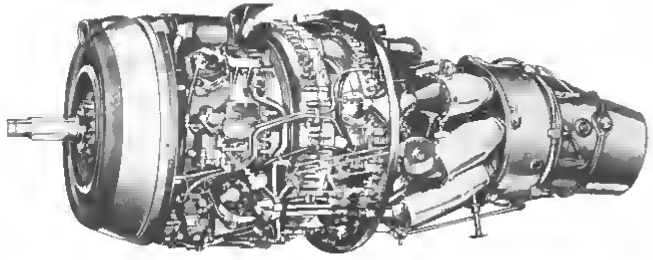
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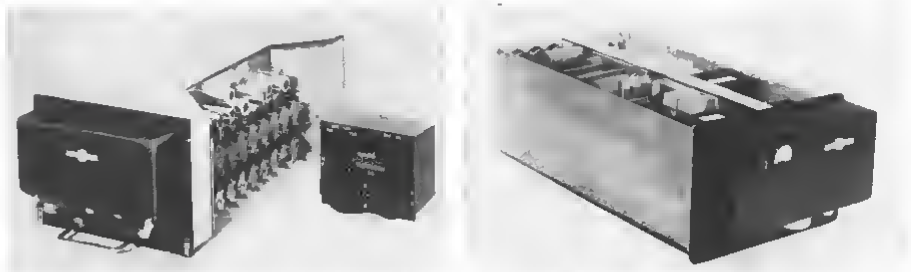
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AN/ARC-58 SINGLE SIDEBAND TRANSCEIVER will provide 28,000 HF channels. Left mockup is receiver, right power amplifier

SSB Transceiver: More Power, Channels

By Philip J. Klass

A new single sideband high frequency transceiver, the AN/ARC-58, is expected to provide a 40-fold (16db) increase in effective power as compared with the double sideband (DSB) sets now used for long-distance military and airline communications.

ARC-58's increase in effective power, however, will not require any major increase in equipment size, weight or power consumption.

Other major advantages of the single sideband technique are:

• **Twice as many channels** can be utilized on the high frequency band (2 to 30 mc.) by the switch from double sideband or amplitude modulation as DSB also is known.

• **Improved intelligibility** is achieved under adverse propagation conditions.

The ARC-58, together with SSB ground equipment, is being developed by Collins Radio Co. under the sponsorship of the Rome and Wright Air Development Centers. Delivery and evaluation are scheduled for next year. The ARC-58, with only minor modifications, is a likely candidate for airline use.

ARC-58 Highlights

Basic characteristics of the new airborne HF transceiver will be:

• **Bi-mode operation.** The ARC-58 will be able to communicate with both new SSB and present AM transmitter-receivers, an important characteristic during the transition period from AM to SSB. When operating with other SSB equipments, the ARC-58 will operate as a suppressed carrier type of single sideband system. (For explanation of terminology, see AVIATION WEEK April 30, p. 63.) When operated with present AM equipments, the ARC-58 will transmit a single sideband plus carrier.

• **1,000 watt output.** The ARC-58 will put out 1 kw. (peak envelope power), giving it approximately 40 times more effective power than 100 watt AM transmitters now used by the military and airlines. However, the ARC-58 will consume only 1,400 watts and this only while the operator is speaking. Thus, average power consumption, a major factor in determining the rating of aircraft generator capacity, is somewhat less. By contrast, 100-w. AM transmitters require 750 to 1,000 w. average power whenever the transmitter is turned on. When used with conventional AM equipment, ARC-58 will generate a single side band plus carrier, rated 250 w. or approximately 2½ times the power of present airborne HF equipments. Thus the ARC-58 should provide much improved HF communications when operated in either mode.

• **Fully automatic tuning.** Pilot will be able to select any one of 28,000 channels, spaced 1 kc. apart in the 2 to 30 mc. band, using a simple cockpit control similar to that used for VHF communications and in recent HF sets. This will automatically tune the ARC-58 transmitter and receiver functions, including the antenna coupler which matches transmitter to antenna to obtain maximum power transfer.

• **Selective calling, teletyping.** The ARC-58 will provide for both air-ground TSK (frequency shift keying) teletypewriter and selective calling service. The latter operates like the selective calling system now used by the airlines, except that it will employ a sequential tone system with a considerably greater number of codes.

The ARC-58 is expected to weigh slightly under 200 lb., including antenna coupler, power supply, selective calling adaptor and a special 15 lb. cooling unit required when equipment is located in non-pressurized areas. This is roughly the same weight as the Air Force's present ARC-21 transceiver, rated for 100 watts AM.

For airline use, the ARC-58 could be stripped down to 150-160 pounds. This compares with about 100 pounds for the Collins 618S transceiver, rated for 100 watts AM and offering only 144 selectable channels in the HF band.

The ARC-58 receiver-exciter will be packaged in a 1 ATR size case, with the transmitter driver and power supply mounted in another 1 ATR size case. The set will be approximately 50 percent transistorized, according to E. W. Pappenfus, assistant director of research and development at Collins. The ARC-58 will employ modular plug-in construction throughout.

SSB Pioneer

Arthur Collins, president of Collins Radio, has long been a strong proponent of SSB, which explains why his company is a pioneer in the field. For several years, Collins has been developing key components and techniques to make SSB feasible for ground-air communications. Two developments are:

• **Mechanical filters.** In an SSB transmitter, the unwanted sideband must be suppressed by more than 60 db. (1,000,000), while the carrier must be attenuated by 10 to 20 db. (10 to 100). The SSB receiver must exhibit extreme selectivity with high rejection of adjacent channel signals if the narrow bandwidth advantages of SSB are to be fully realized. The mechanical filter, consisting of a series of resonant disks driven by a magnetostrictive transducer, provides nearly ideal rectangular attenuation characteristics for both applications.

• **Stable frequency reference.** In a sup-



to err is human . . .

. . . but very costly

Replacing a blown fuse with one of the wrong rating is common . often the natural thing to do when the correctly rated fuse is not at hand

This mistake, whether it is in error or an expedient means of putting the protected equipment back in service, is costly

It accounts for poor product reputations and costly service expense to manufacturers

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And, since HEINEMANN CIRCUIT BREAKERS serve as a power switch, too, overall costs of a circuit breaker and comparable fuse installation are quite close

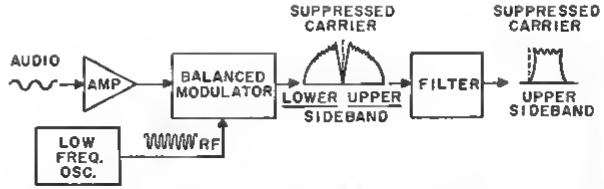
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Heinemann General Purpose Three Pole Circuit Breaker Available in odd or fractional ratings from 0.010 to 70 amperes (Other models to 100 amperes) Ratings are not effected by ambient temperature

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Circuit breakers



"FILTER"-TYPE SSB GENERATOR diagram, showing how filter removes one sideband.

pressed carrier type of SSB system, the receiver itself must generate its own carrier for demodulating the incoming signal If this receiver generated frequency differs by only a few parts in a million from the transmitter frequency, this in combination with the Doppler effect due to airplane velocity can make the transmission unintelligible While such frequency stability requirements are not too difficult to meet in ground-based equipment, they pose a problem in airborne equipment Collins has developed an airborne frequency reference which reportedly has a stability of one part in 10 to 100 million over a 24 hour period A sophisticated servo system maintains the temperature of the crystal oven to within 0.01 degree, according to Pappenfus The unit employs a contour-cut crystal, mounted inside a vacuum bottle to further isolate it from ambient temperature effects

Low Distortion

Distortion, created by the generation of spurious harmonics, is far more serious in single sideband than in AM It can effectively increase the bandwidth of SSB, causing a signal in one channel to "splatter" into adjacent channels, creating interference

In SSB, the desired audio intelligence (modulation) is introduced into a balanced modulator along with a low frequency RF carrier The balanced modulator generates the two sidebands and simultaneously suppresses the carrier The next step is to eliminate the unwanted sideband, which Collins does by means of its mechanical filter The filter also limits the bandwidth of the desired sideband to approximately 3,100 cycles, which is sufficient to insure adequate voice intelligibility The mechanical filter attenuates the unwanted sideband by at least 60 db and the residual carrier by 12-18 db, Collins says

Dual Functions

The remaining single sideband signal, after being heterodyned twice to obtain the desired transmitting frequency, must be boosted by a factor of 1,000 in the RF amplifier To accomplish this, without introducing undesirable distortion and increasing bandwidth, Collins employs RF feedback in the power amplifier Automatic load control also is employed to insure that modulation peaks do not overload the amplifier

To hold down size and weight, ARC-58 is designed as a transceiver rather than as a separate transmitter and receiver This means that many circuits have dual roles in transmitting and receiving

While this does not permit simultaneous transmission and reception, the pilot can carry on a two-way conversation almost as he would by telephone The ARC-58 remains connected in its receiver mode of operation until the pilot begins to speak, which automatically switches it over to function as a transmitter (To prevent cockpit noises from actuating the transmit mode the pilot's microphone button must be depressed before automatic switchover will take place.)

The ARC-58 will have a selector switch to enable the pilot to transmit and receive on either the upper or lower sidebands, transmit a single sideband plus carrier and receive conventional double sideband AM.

Flush Antennas

Collins designed the ARC-58 antenna coupler for compatibility with tail cap antennas used on high-speed aircraft A small variable inductor, which instantly and automatically tunes when the pilot selects a new frequency, is designed to be located in the tail assembly The more complex tuning control, which "examines" the phase and ratio of line voltage and current and then causes servo systems to adjust a vernier inductor, capacitor and auto transformer to achieve proper antenna matching, can be located inside the fuselage where it is more accessible for maintenance

The tail-mounted inductor achieves an approximate match as soon as the set is tuned to a new frequency and need not await initial transmission of RF energy which is necessary for operating the vernier matching control unit.

IATA Compatibility

Although ARC-58 was developed as a prototype for USAF and possible Navy use it comes close to meeting the operational requirements set forth by the International Air Transport Asso-

advanced technique

AVIONICS

fighter situation display by AVION



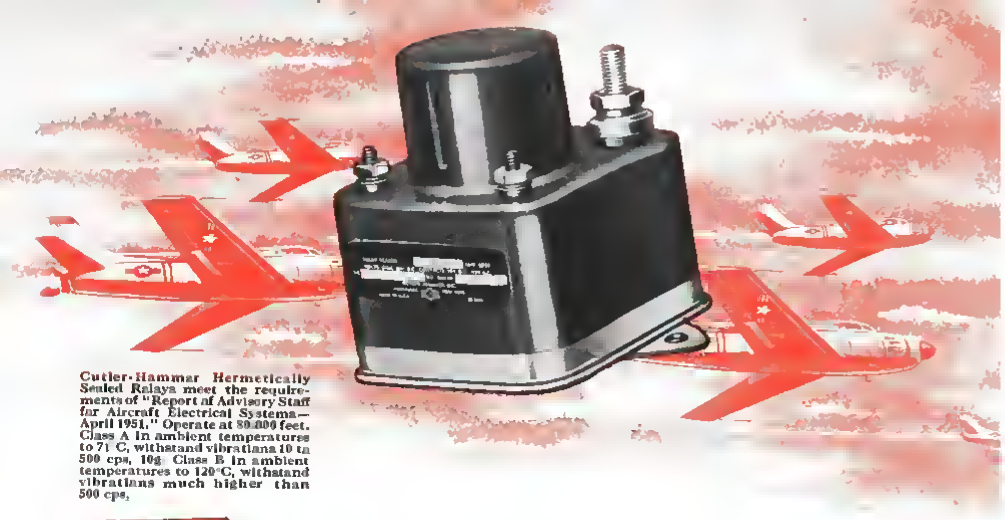
Fighter Situation Display (FSD) is an automatic, continuous indication on a map of the aircraft position during flight.

Developed by Avion for the Air Force. FSD eliminates manual computation and facilitates pin point navigation

Avion's flexibility and ingenuity, coupled with extensive experience in Electronics, Mechanics and Optics can better serve you.

Investigate the career opportunities in our expanding organization.

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Cutler-Hammer Hermetically Sealed Relays meet the requirements of "Report of Advisory Staff for Aircraft Electrical Systems—April 1951." Operate at 80,000 feet. Class A in ambient temperatures to 71°C, withstand vibrations 10 to 500 cps, 10g. Class B in ambient temperatures to 120°C, withstand vibrations much higher than 500 cps.



Ready-Reference Panel for Aircraft Designers

Cutler-Hammer offers this ready-reference component panel as a further service in the aircraft industry. Priced far below value of devices mounted on panel. Saves costly delays and confusion. Ask your nearest Cutler-Hammer office or write direct to Milwaukee for complete information.

Cutler-Hammer Hermetically Sealed Relays set new standards in aircraft control

Cutler-Hammer Hermetically Sealed Aircraft Relays are the result of years of intensive development and research by Cutler-Hammer engineers in close cooperation with leading aircraft builders. Designed for use in higher ambient temperatures and better able to withstand shock and vibration, they meet both present and future needs for environment-free dependability. They offer longer life and contribute directly to increased safety.

Only permanent non-aging materials are used. All metal parts (except those carrying current or those in the magnetic structure) are stainless steel. The stainless steel case is covered *both outside and inside* with a special blue glass fused thereto at extremely high temperatures. This special glass is chip-proof and has great dielectric strength with maximum recovery should a flash-over occur.

These new relays are standardized to be generally interchangeable with presently-used unsealed relays. The line is being extended continuously as to types and capacities. Be sure you have latest data and are listed to receive all new information as released. Write or wire today.

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1471 St. Paul Avenue
Milwaukee 1, Wisconsin.

Cutler-Hammer Leadership in Aircraft Control

Cutler-Hammer has long held the respect of the aircraft industry because this company has been *part* of the aircraft industry for 35 years. It has never been an opportunist supplier. It has *pioneered* the designs others have followed. It has sought to serve, not merely sell. It has been in the forefront of all cooperative activity in standardization and long-range planning. It has supplied complete lines of equipment, not merely the items of widest use and most profitable manufacture. Today, as for the decades past, Cutler-Hammer engineers are working closely with the aircraft industry's leaders in thinking ahead, planning, designing and building for the future. Here is the record:

1920 Cutler-Hammer designed and manufactured the first line of switches ever created specifically for use in aircraft.

1938 Cutler-Hammer designed and manufactured the first d-c power relays ever created specifically for use in aircraft.

1943 Cutler-Hammer designed and manufactured the first a-c power relays ever created specifically for use in aircraft.

1949 Cutler-Hammer started development of the first environment-free power relays for use in aircraft.

1953 Cutler-Hammer submitted samples and certified test reports on the first hermetically sealed power relay to WADC and Bu. Aer. Cutler-Hammer configuration was adopted as industry standard by ASG.

1955 Cutler-Hammer designed and manufactured the first one hole mounting Lever Lock aircraft switches.

CUTLER-HAMMER
AIRCRAFT CONTROL
C-H

cation at its recent SSB meeting in Montreal.

With conservatism, IATA asked for a suppressed carrier type of SSB which could also be operated so that it transmitted a burst of carrier during brief pauses in the speaker's conversation. Such intermittent or "controlled carrier" SSB might be employed until such time as the airborne frequency reference had proved its dependability. Although the ARC 58 does not now include controlled carrier type operation, this feature could be provided if required in an airline version, Pappenfus told AVIATION WEEK.

IATA Selection

IATA concluded that it would be wise to use a specific one of the two sidebands in order to reduce co-channel interference. IATA reasoned that if everyone used the same sideband (either upper or lower), speech from adjacent channels would always be inverted, hence would have a less destructive effect on the intelligibility of the wanted signal. Another reason is that radio energy would be more evenly distributed throughout the spectrum.

Knowing of no scientific reason for favoring one sideband over the other, IATA arbitrarily selected the upper.

Air Force tests on the Collins SSB system may indicate either that such standardization within the military is also desirable for voice communications or that it is unnecessary.

Radio Corporation of America, which developed the ARC-21 high frequency transceiver, is developing techniques which will permit its modification for SSB operation. The RCA financed program has increased the normal 100 w AM output of the ARC-21 to 200 w peak envelope power when operated SSB.

The firm hopes to increase this to 350-400 w. For operation with other AM equipments, the set will transmit a single sideband plus carrier.

ARC-21 Modification

Initial point-to-point testing of an SSB version of the ARC-21 has been completed and airborne tests by Wright Air Development Center are to get under way soon.

If the USAF decides to modify its ARC-21s for SSB, the sets will be returned to RCA for factory modification. The SSB ARC-21s will be completely interchangeable with the present AM sets insofar as interconnecting cables and hardware so that no modification of using aircraft will be necessary, RCA says.

For the airline market, Collins appears to have the jump over competitors. In reply to an AVIATION WEEK query, a spokesman for Bendix Radio says: "We are not active in the SSB field at the present time and do not have any plans to development equipment in the foreseeable future."

Wilcox Electric Co. says the firm is experimenting with SSB. Wilcox may have ground-based SSB equipment available within a year. Hoffman Electronics Corp., although not an airline avionics supplier, has been active in the single sideband field for some time. Hoffman markets an SSB converter for ground based AM equipments.

Stanford Research Institute is investigating basic single sideband techniques including the phasing method of generating SSB signals under military sponsorship.

With HF radio spectrum congestion getting worse because of expanding civil-military aviation needs there can be little doubt that single sideband is coming rapidly. The Federal Communications Commission recently adopted a policy of requiring SSB for all future fixed radiotelephone services operated below 25 mc.

FCC might extend this philosophy to air-ground communications if the military-airlines do not voluntarily beat it to the punch.

(This is the second and concluding article on single sideband techniques and equipment. The first article was published Apr. 30, p. 62.)



Doelcam

LINEAR ACCELEROMETERS

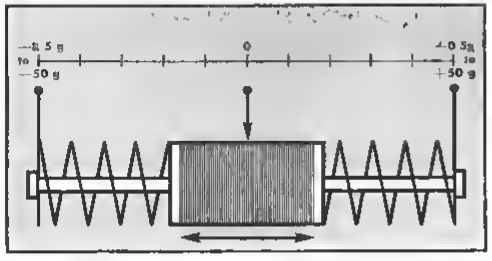
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NON-PENDULOUS TYPE



Shown Actual Size

Doelcam Linear Accelerometers sense positive or negative accelerations or both in either the vertical or horizontal plane. Designed for use in aircraft and missiles, they are available in a variation of ranges from ± 0.5 g to more than ± 50 g's depending upon requirements. These units consist of a centrally located mass restrained by coil springs and supported on a linear-type ball-bearing. Any movement of the mass on either side of the null displacement position is measured by a potentiometer pick-off, providing a high level output signal. Viscous damping is incorporated for improved dynamic response. Zero cross-coupling is inherent with this true linear non-pendulous design. (Cross-coupling is defined as a change in output signal caused by an acceleration applied from any direction in a plane normal to the sensing axis). Excitation may be as high as 100 volts (A-C or D-C) depending on the potentiometer resistance.



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Write for Bulletin LA-11

VTOL Landing System Developed By Convair

Los Angeles—An electronic rate of descent indicator for vertical takeoff and landing has been developed from an X-band CW Doppler radar by Convair San Diego engineers.

When landing or taking off the pilot sights over his left shoulder, taking in the up-down meter mounted to the rear of the seat. Four colored lights are installed on the left wing pod which houses the rate-of-climb system. A dual channel microwave receiving and gating system differentiate between ascent and descent.

The electronic unit weighs 23 lb, and the complete microwave unit weighs eight lb. Any system malfunction in the Doppler activates a red flag on the instrument panel.

New Avionics Bulletins

Rack and panel connectors. Catalog. Rl lists standard miniature and circular MS connectors with application data. (16 pp.) American Phenolic Corp., 1830 So. 54th Ave., Chicago 50, Ill.

Telemetering receivers four types covering frequency range of 55 to 260 mc. Two-page bulletin. Airtronics, Inc., 914 Joseph-Flair Drive, Silver Spring, Md.

Gyros, vertical, floated rate and directional. Four-page bulletin No. 350. Gyro mechanisms, Div. North-Kirby Corp., Bellerose 1a, L. I., N. Y.

Computer components for both analog and digital computers. four-page bulletin. Librascope, Inc., 808 Western Ave., Glendale, Calif.

Miniaturization skills available to industry at the Elgin National Watch Co. 12-page brochure. Write company's Ordnance Division, Elgin, Ill.

"Alternating Flow of Fluid in Tubes." 12 page technical publication identified as Instrument Notes No. 20, available from Statham Laboratories, Inc., 12401 West Olympic Blvd., Los Angeles 64, Calif.

Magnetic recording-reading heads for digital computers. Bulletin J-11. Ren Co., Inc., Data Storage Devices Div., 1725 Cloverfield Blvd., Santa Monica, Calif.

Microwave components. Catalog 56CP describes 150 microwave components and pieces of test equipment for use in radar systems and microwave laboratories. Microwave Associates, 23 Cummington St., Boston, Mass.

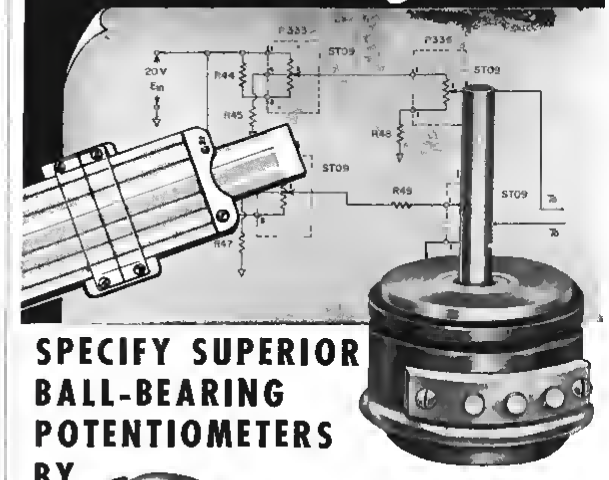
Radio interference and field intensity meter for very low frequency work. four-page folder. Stoddart Aircraft Radio Co., Inc., 6644 Santa Monica Blvd., Hollywood 38, Calif.

Airborne navigation equipment. 11 pp. Chatham Electronics Division of Giro Corp., Livingston, N. J.

Fluorocarbon rupper-like plastic for printed circuitry. Includes application data. Bulletin AR-2e (2 pp.) International Resistance Co., 401 No. Broad St., Philadelphia 8, Pa.

Analog-to-digital converters. Both binary and binary coded decimal types. Bulletin No. CR-183. (4 pp.) Coleman Engineering Co., Inc., 8040 West Jefferson Blvd., Los Angeles 16, Calif.

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Designed for those applications where less than the best means failure . . . by the world's first and leading manufacturer of precision single-turn wire-wound potentiometers. Advanced production and quality-control techniques by the pioneer in mass production of precision potentiometers offer unequalled delivery . . . of prototype and production quantities.

All models of the TIC Ball Bearing Series are designed to the latest industrial dimensions. Servo mounting is AIA standard. Stainless-steel ball-bearing construction is used for low-friction low torque operation. Other precision mechanical features include precious-metal slider contacts, centerless ground stainless-steel shafts and one-piece stainless steel clamp ring developed by TIC for simple, precise phasing of individual units of ganged assemblies.

Designed for precision applications in automatic control systems, the subminiature ST09, for example, features standard independent linearity of ±1% (0.3%, special) of the total resistance, and ±5% standard total resistance accuracy. High resolution, equivalent noise resistance less than 140 ohms, wide standard temperature range (−55°C to 80°C) increases application versatility. ST09 is available in standard resistances of 100, 200, 500, 1K, 2K, 5K, 10K, and 20K.

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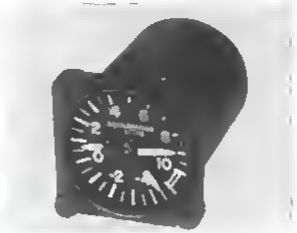
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Chamber Tests Skin Heat

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American Research Corp., 11 Brook St., Bristol, Conn



Indicator Shows —5 to +10G

Three pointer accelerometer indicator has a range of —5 to +10G and shows vertical accelerations when the plane of the mounting lugs is vertical The indicator weighs 0.9 lb and is built to MIL-A-5885A and to withstand the basic environmental tests The case is 2¼ in. diameter by 3⅜ in. long to meet MS28025

Burton Manufacturing Co., Colorado Ave. at 26th St., Santa Monica, Calif.

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Any degree of travel, from 5 to 60 deg clockwise or counter-clockwise rotation, in increments to one degree, is supplied Torque values to 15 lb-in or more are available in a unit measuring 1⅛ in. diameter and 1⅛ in. long Units meet MIL-S-4040A

Pacific Solenoids, Inc., 208 Standard St., El Segundo, Calif.

Ballistic Film Analyzer

New series of ballistic film analyzers and recorders for checking film records made by high-speed motion picture photography, theodolite data and other types of film records, combines optical and measuring systems and can handle 8 mm., 16 mm., 35 mm. single or double frame and 70 mm

Various measurement and output systems are available giving analog or digital output from either a stock flying spot control or a spheroid crosswire control The stick controls the X, Y and angular position of a moving reference on the screen and provides the operator with a measuring system in



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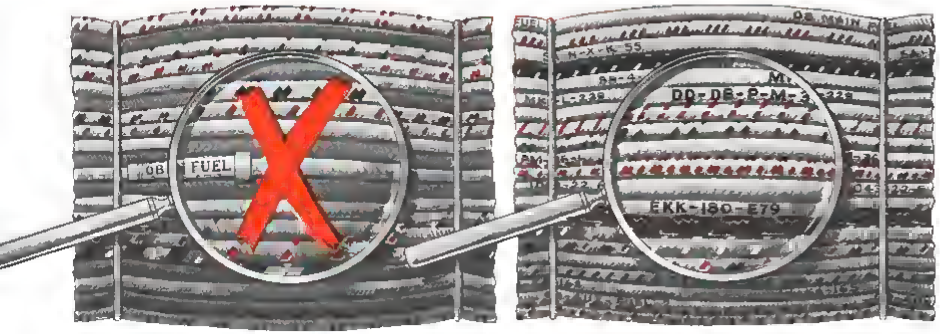
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WW500 (MIL-W-7139-A) AND COLOR CODED FOR TEFLON CABLE STAMPED IMMEDIATE IDENTIFICATION!



Unique Identification System *Saves Time, Saves Weight, Saves Money!*

Warren Wire is first to introduce this time-saving, money-saving cable identification system to the aircraft and guided missile industry. Now with WW500 (MIL-W-7139-A) Teflon-coated low tension cable, the harness can be broken into at any point and every conductor *immediately* identified by stamped numbers or color coding. Never again need electricians put in tedious, costly hours ringing out cable systems or checking identification tags in inaccessible places.

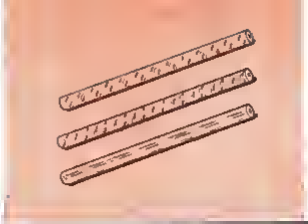
STAMPING — When white Teflon-coated WW500 (MIL-W-7139-A) is used, manufacturers just stamp on their cable identification numbers at about three-inch intervals with standard marking equipment. (White WW500 always available in stock.)

COLOR TRACERS — Good news for guided missile manufacturers is that WW500 can also be obtained in 10 solid colors as well as in an unlimited number of color combinations. This makes it just as easy to identify shielded as exposed cables, because the same colors can be used in the sheath to identify the individual conductors it contains.

IN ADDITION TO WW500 *Warren Wire contributes to aircraft safety and efficiency with: • Harness Wrapping Tape of 10 Mil Teflon-Coated Glass Fabric with adhesive backing • Teflon-Coated Glass Lacing Cord • Teflon Magnet Wire*

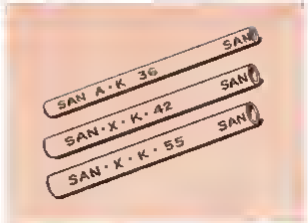


WW500 COLOR TRACER SYSTEM. Protective sheath is color coded to correspond with color of cables it holds.



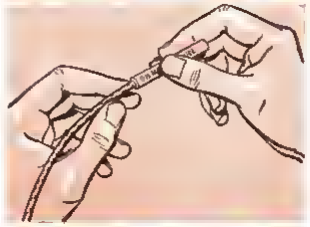


WW500 STAMPED WHITE CABLE. Identification numbers can be stamped on cable automatically with standard marking equipment.



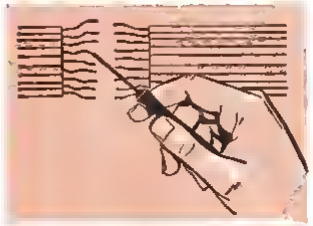


WW500 CUTS ASSEMBLY COSTS. Eliminates tags and clamps. Tagging takes time, piles up labor costs. Tags can and do drop off.



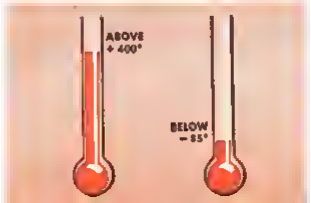


WW500 OUTMODES RINGING OUT. This tedious aural tracer system is now replaced by a remarkably rapid means of visual identification.





WW500 CAN BE USED ANYWHERE. The ideal all-purpose low tension cable, because of its extraordinary heat-and-cold resistant characteristics, and its imperviousness to chemicals and solvents.



Advantages

- Eliminates tagging
- Saves weight
- Eliminates guessing
- Eliminates ringing out
- Cuts assembly costs
- Can be used anywhere

Characteristics

- World's most heat-and-cold resistant cable. Operates efficiently in temperatures *far above* +400°F to *well below* —85°F.
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G-E Servo-temperature Indication Systems Chosen by Convair for Navy Turbo-prop R3Y

New General Electric Systems Have Expanded-scale Dual Repeater Indicators; Give High-accuracy Temperature Readings for Both Pilot and Flight Engineer

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FIRST OF ITS KIND on any operational aircraft, the G-E servo-temperature indication installation on the R3Y includes eight amplifiers one for each turbo-jet, eight two-inch master indicators for the flight engineer, and four three-inch dual repeater indicators on the pilot's instrument panel. Systems report turbo-jet temperatures simultaneously to both pilot and flight engineer.

EASY TO READ expanded scale used on G-E temperature indicators lets flight personnel read engine temperatures quickly. This avoids the difficulties encountered in reading two-scale or sub dial type indicators. G-E dual pointer indicators save valuable space on pilot's instrument panel, give two readings on the same instrument. High accuracy of G-E servo-temperature indication systems helps assure optimum engine performance, lengthens engine life.

AVAILABLE IN MANY OTHER TYPES, General Electric servo-temperature indication systems can provide signals for control initiation proportional to temperature, time over temperature indication, or for dual repeater indicators.



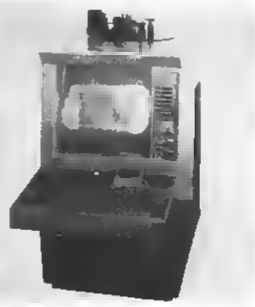
EXPANDED SCALES used with G-E systems allow high accuracy temperature readings in critical ranges.

G-E repeater indicators are readily adaptable to the requirements of X-model aircraft where simultaneous readings on both pilot's panel and photo panel are desired.

FOR FURTHER INFORMATION on G-E servo temperature indication systems or on any G-E aircraft instrument, contact your nearest G-E Apparatus Sales Office or write Section 586-3, General Electric Co., Schenectady 5, N. Y.

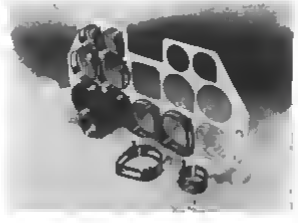
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the medium accuracy range (one part in 1,500). The spheroid control allows for positioning of two precise cross-wires, giving an output accuracy of one part in 5,000 with a resolution of one part in 10,000. Automatic outputs are available to remote typewriters, card punching or paper tape punching machines and/or automatic plotting boards.

Benson-Lehner Corp., 11930 W. Olympic Boulevard, Los Angeles 64, Calif.



Instrument Mount Clamps

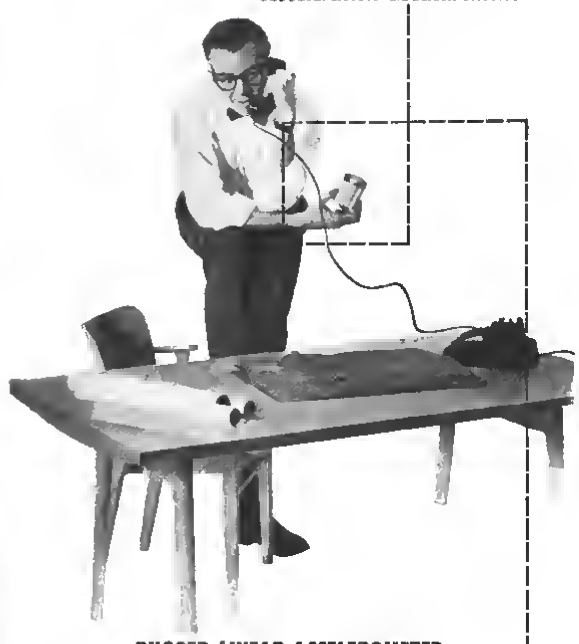
Designed for quick and easy installation and removal of instruments from the front of a panel, non-magnetic AN approved clamps are available in 1½ in., 2 in. and 3½ in. sizes. Clamps will fit behind nine-sixteenth and one-quarter-inch panels without adjustment. A cam action on the master screw tightens the clamp around the instrument. Special sizes and configurations are also available.

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Model 143 scintillation counter has a built-in loudspeaker alarm which starts giving out a tone when a preset gamma radiation level is reached and increases in pitch proportionally when this level is exceeded. Unit has provisions for headphones for use while flying or using in a noisy place; also a built-in

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RUGGED LINEAR ACCELEROMETER MAINTAINS ±2% ACCURACY DESPITE EXTREME SNOCK AND VIBRATION

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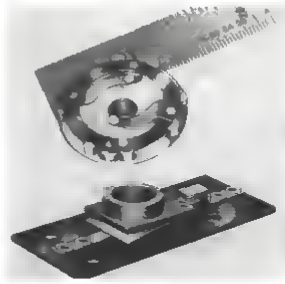
MARTIN
DENVER DIVISION

battery tester that individually tests each battery in a few seconds. Tubes are of the plug-in type.—Gardiner Electronics Co., 2545 East Indian School Road, Phoenix, Ariz.

Miniature rotary switches for instruments, computers, RF switching, etc., are available in both shorting and non-shorting types with from one to four poles per deck and two to thirty-two positions per deck. Up to six decks may be ganged. Torque is from 3 to 5 inch-pounds for a single-deck switch. Item measures 1¾ in. square with a back panel depth of 1 in. for the first deck, plus ⅝ in. depth for each additional deck.—Shallcross Manufacturing Co., Collingdale, Pa.

Miniature motor-driven sampling switch has 20, 30, 40 or 45 contacts per pole, one to four or more poles. DC, 60 or 400 cycle AC integral motor is optional. Convenient cables and plugs, one plug per pole. Each pole can be conveniently adjusted in phase while switch is operating. Approximate size: 1½ x 1½ x 6⅞ in.—General Devices, Inc., P. O. Box 253, Princeton, N. J.

Miniaturized synchro-snap speed control device, a protective unit for electronic equipment, business machines and computing devices, measures 1⅛ in. in diam-



eter. It features instantaneous snap action, is predictable, has an accuracy to ¼ of 1%, and has a uniform operation life of 1 million to 1.5 million operations or higher as required. Switch is also suitable for speed control of guided missiles and servo-mechanisms.—Torq Engineered Products, Inc., Interstate St., Bedford, O.

Series 33 tachometer takeoff heads, used with Metron indicators, measure high speeds—5000 to 30,000 rpm. or low speeds—½ to 100 rpm. No brushes, slip rings or other parts that need regular maintenance or replacement are used. Double-pole, double throw (dpdt) switch together with a capacitor acts as a speed sensing element.—Metron Instrument Co., 432 Lincoln St., Denver 3, Colo.

Screen printing kit for duplication of printed circuits, nameplates, precision dials, etc., in prototype or quantity amounts (from one to more than ten thousand). Item contains resist ink, squeegee, Du Pont screen process film, chemicals and instruction brochures.—Albert Geduld, 178-184 Central Ave., Hackensack, N. J.

Flush pin gage with a 5 to 1 amplification is practical down to manufacturing tolerance of .002 in., with larger tolerances the step is much larger for easier reading. Advantages of amplifier are that it is easily seen and setting master, mounting bracket and protective hood are superfluous.—A. M. DeLeo & Associates, Inc., 18220 W. 7 Mile Rd., Detroit 19, Mich.

Kluson KX4 hermetically sealed line switch is a precision, snap-action limit switch designed for use in aircraft, guided missiles, industrial controls, etc. Actuating arm which operates wave-type metal diaphragm is locked to eliminate rotating, switch is sealed in a controlled atmosphere and internally designed to provide maximum clearance between current carrying parts.—Spencer

Bendix

Builds a Better Cable Clamp—the

AN3057B

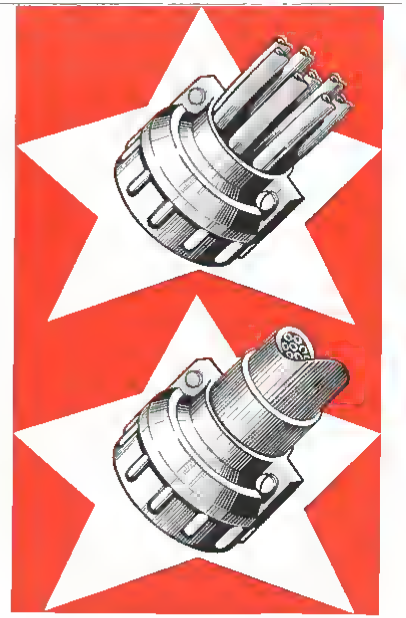
Inexpensive, Efficient, Versatile

The new Bendix AN approved AN3057B cable clamp is now available. Engineered by Bendix to the highest-quality standards, this cable clamp offers major design improvements. The clamping action is radial and completely eliminates wire strain and chafing by holding the wire bundle firmly in rubber. This clamp will accommodate a wide range of wire bundle sizes, but an even greater range can be handled through the use of the Bendix AN3120A accessory telescoping sleeve.

The new AN3057B cable clamp will also waterproof multi-conductor rubber-covered cable on the rear of a connector, or where moisture-proof entrance through a bulkhead or into an equipment box is required.

Complete detailed information is available on request.

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SIDNEY, NEW YORK



WANTED! ENGINEERS TO HELP MAKE LONG RANGE MISSILE HISTORY

North American's Missile Projects Offer A New Engineering Adventure

With complete weapons system responsibility for the SM-64 NAVAHO Intercontinental Guided Missile, North American is engaged in one of the most challenging programs yet offered. But every inch of progress is a tough scientific battle. New means are daily being found to solve the complex problems which the development of long range missiles presents in the fields of structures, temperatures and aerodynamics. But most important of all, *men* must be found who thrive on this kind of challenge — men who are really excited about this new missile science. Are you one of them?

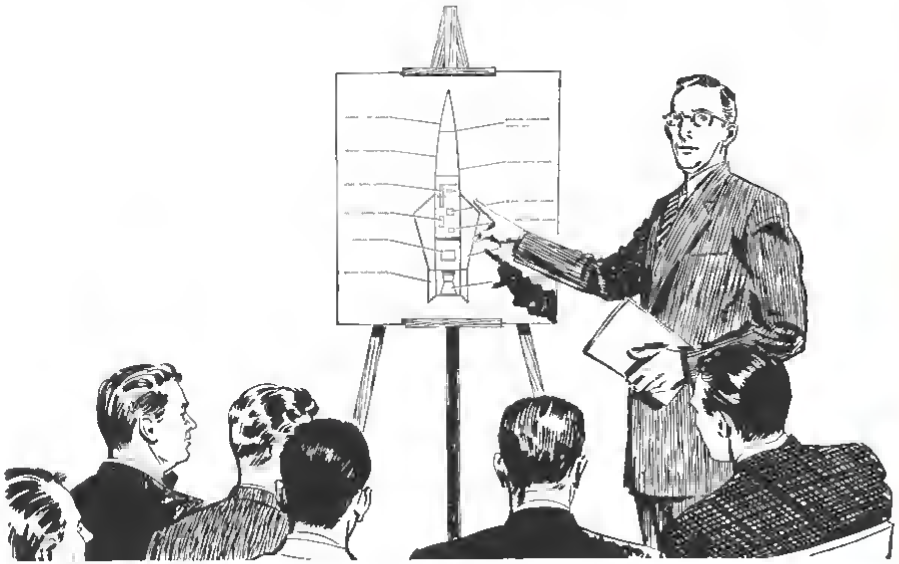
If you qualify in one of the fields we have listed below, chances are you can qualify for this unique expedition into the technology of the future. We would like to tell you about all the physical and professional advantages of a career in North American's Missile Development Engineering.

Please contact us for the full story.

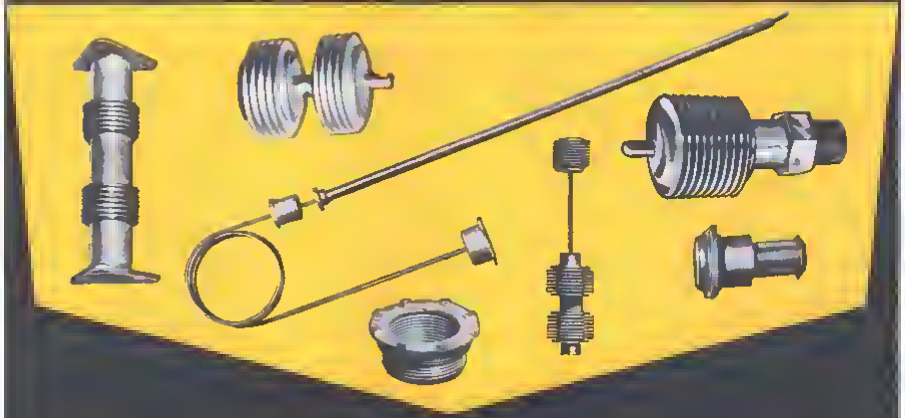
Instrumentation Design, Development & Application — **Standards, Drawings Checking, Specifications Writing**
Structures, Stress, Flutter and Aeroelasticity — **Component and System Reliability Engineering** — **Thermodynamics**
Missile Airframe Design — **Hydraulic, Pneumatic & Servo Engineering** — **Armament Systems & Components Engineering**
Aerodynamics — **Engineering Flight Test** — **High Temperature Materials Engineering** — **Mechanical & Electrical Design**

Contact: R. L. Cunningham, Missile Engineering Personnel Office
Dept. 91-20 AW, 12214 Lakewood Boulevard, Downey, Calif.
Phone: LOgan 5-8651, Ext. 518
Interviews: 8 A.M. to 9 P.M. Monday Through Friday

NORTH AMERICAN AVIATION, INC.



HOW TO SAVE TIME AND MONEY ON COMPLETE BELLOWS ASSEMBLIES



No matter why or how the bellows principle enters into an assembly, Fulton Sylphon can assemble the right bellows and related accessories or mountings into a complete device that meets your specifications. In doing this Fulton Sylphon offers important design help, specialized skill in joining bellows with other members, and modern production facilities for on-time deliveries.

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As the No. 1 source for bellows and bellows assemblies, Fulton Sylphon furnishes a wide range of characteristics and sizes in many different metals. Single or multiple ply, and braid covered bellows constructions are available for various abrasive and pressure conditions.

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Name_____ Title_____

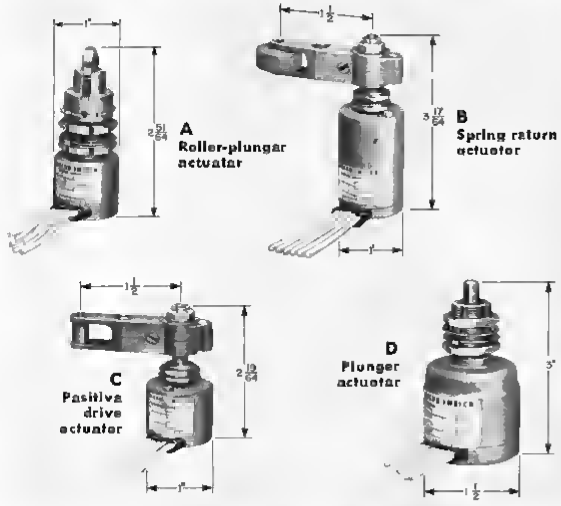
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MICRO precision switches

...THEIR USE IS A PRINCIPLE OF GOOD DESIGN



These small, completely sealed, cylindrical switches provide unusual design flexibility

Here are four examples of a family of MICRO SWITCH environment proof switches that provide unusual flexibility for aircraft designers.

With them MICRO SWITCH introduces an entirely new concept in airborne switches. The switches are small, completely sealed, cylindrically shaped and of high electrical capacity. They are ideal for use on landing gears, flaps and other exposed locations. They are equal in performance and have more versatility of application than switches several times their size and weight.

The switches are sealed so that operating characteristics are unaffected by changes in atmospheric pressure, humidity or temperature. The switching chamber within the housing is evacuated, then filled with dry inert gas and sealed. This prevents any affect of atmospheric changes such as "breathing" or collection of moisture within the switch chamber. The actuator operates through a seal which keeps dust or moisture from entering. Plunger-type switches have an ice scraper ring.

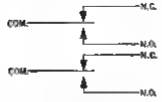
The switches are designed for bracket type, or through-hole mounting. Leads are supplied, one for each terminal, the number depending on contact arrangements and terminals. The leads project at a 90 degree angle from the base of the switch. They may be run in any direction by rotating the switch on its axis.

The switch type designated as (A) has a roller-plunger actuator for actuation by cams or slides, (B) has a spring return actuator also for cam or slide operation, (C) has a positive drive actuator for linkage operation, the type designated as (D) is designed with a plunger actuator for in-line-motion operation.

For complete information on these new cylindrical switches, types of actuators available and circuitry developments, contact MICRO SWITCH Engineering Service at your nearest branch office. Let them show you the complete line of environment proof, hermatically sealed switches for severe airborne service. It pays to bring your switch problems to MICRO SWITCH.

Choice of Contact Arrangements and Electrical Ratings

For Switch Types A, B, and C



CONTACT ARRANGEMENT
Two single pole, double throw circuits

ELECTRICAL RATING at 28 volts D-C (in unsealed condition)*

INRUSH
Normally closed, 24 amperes
Normally-open, 24 amperes

AT SEA LEVEL
Resistive, 4 amperes
Inductive, 3 amperes
Motor, 4 amperes

AT 100,000 FT.
Resistive, 4 amperes
Inductive, 2 amperes
Motor, 4 amperes

Electrical ratings established with tests on unsealed switches

For Switch Type (D)



CONTACT ARRANGEMENT
Two double pole, double-throw circuits

ELECTRICAL RATING at 28 volts (in unsealed condition)*

INRUSH
Normally closed, 30 amperes
Normally-open, 30 amperes

AT SEA LEVEL AND AT 100,000 FT.
Resistive, 15 amperes
Inductive, 10 amperes
Motor, 5 amperes

Electrical ratings established with tests on unsealed switches

MICRO SWITCH

A DIVISION OF MINNEAPOLIS HONEYWELL REGULATOR COMPANY

In Canada: Leaside Toronto 17, Ontario • FREEPORT, ILLINOIS

Thermostat Division, Metals & Controls Corp., 34 Forest St., Attleboro, Mass.

N-401, regulated high voltage power supply, provides continuously variable voltage from 500 to 1800 v positive, at load currents up to 5 ma. Polarity is positive or negative with front panel control. Additional features of the unit are high current capacity, low output impedance, and rapid surge recovery time.—Hammer Electronics Co., Inc., P. O. Box 531, Princeton, N. J.

Electric tachometer indicator that is a hermetically sealed, remote indicating unit to operate for engine speeds of 0-4,000 rpm. It is mounted in a two-inch diameter case 4¼ in. long and



weighs 0.9 lb. Unit is built to Specifications MIL-I-7098 and MIL-I-7186 and will withstand all basic environmental tests.—Burton Manufacturing Co., Colorado Ave., Santa Monica, Calif.

Sectional impregnated abrasive buff developed for all ferrous and nonferrous metals, is made of specially treated biased cloth impregnated with selected abrasive grains bonded throughout its entire construction. Buffs can be altered by the use of conventional spacers to adjust cutting action and provide greater coverage.—Coated Abrasives Division, Carborundum Co., Niagara Falls, N. Y.

Threaded inserts for plastics, rubber, die castings and potting compounds are designed to be molded directly into the product and require no secondary operations for inserting or locking. They are knurled to prevent rotation and hold them in place; additional strength against pullout is obtained by two circular relief bands on each insert.—Standard Insert Co., 12270 Montague St., Pacoima, Calif.

Vapor degreaser, incorporates a cool dip rinse to wash off chips and other insolubles. Time cycles are adjustable. Units range in size from 1,800 to 4,000 lb. per hour with electrical, steam or gas heat.—Phillips Manufacturing Co., 5415 W. Touhy Ave., Chicago 45, Ill.



Valve Talk

FOR WM. R. WHITTAKER CO., LTD.
BY MARVIN MILES

Because missile divisions and engineering groups working on missile projects can better be served by specialists, Whittaker has established a separate missile section under field engineering.

Heretofore, during the growth of missile design, the valve company's field engineers have divided their time between the requirements of aircraft production and those of the missile projects.

But the surging development of unmanned "birds" in all categories has created a demand for highly critical valve performance that can best be met by experts who understand the complex problems involved, and can interpret them for efficient design and production.

Whittaker has been working on missile valves for some two years now, but only recently has the state of the art outreached the swirl of confusion that marked the first era of development when designers of the "birds" themselves weren't quite sure what they wanted in the way of system equipment—or couldn't detail their needs to suppliers because of super-secrecy.

This trial-and-error period for both the missile manufacturers and the equipment producers came to an inevitable end with the general growth of "know how" in the missile field that took the projects out of the dream room and leveled them into realistic channels.

Gone are the weird figures and formulas marking the early missile valve specifications that confronted such companies as Whittaker—replaced by solid requirements based on research and experience.

Yet there's a vast difference in the valves for aircraft and those for missiles—a difference in design, production and, of course, performance, for tolerances are extremely critical and safety margins almost nil.

Take an average aircraft valve. If the specs call for it to handle 75 pounds pressure per square inch, it very likely will have a tolerance of plus or minus seven p.s.i. But a missile valve by comparison might have a tolerance of only one-half p.s.i.—or less. And tolerances must be held. There's absolutely no margin for error.

The jump into the missile field brought many a revelation to Whittaker and many a headache too, sealed to the maze of problems that confront missile manufacturers.

Almost immediately it was found that to lay out a valve system for a "bird" it was virtually necessary to lay out the missile itself. Some of these projects took a great amount of space—so much in one instance that a parking lot had to be emptied.

The company's engineers found themselves working with such chemicals as liquid oxygen, helium, hydrogen peroxide, nitric acid and sulphuric acid. They were forced deeper into ingenuity and the extended use of skills. They ran into unforeseen expenses such as a test program with helium wherein thousands of cubic feet of gas escaped on every test—at about ten cents per cubic foot.

They were confronted with the design of intricate valves that can interpret delicate electronic signals to control thrust and maneuver by metering high pressure flows to a whisper—problems of holding pressures at varying flows . . . of maintaining flows under changing pressure conditions.

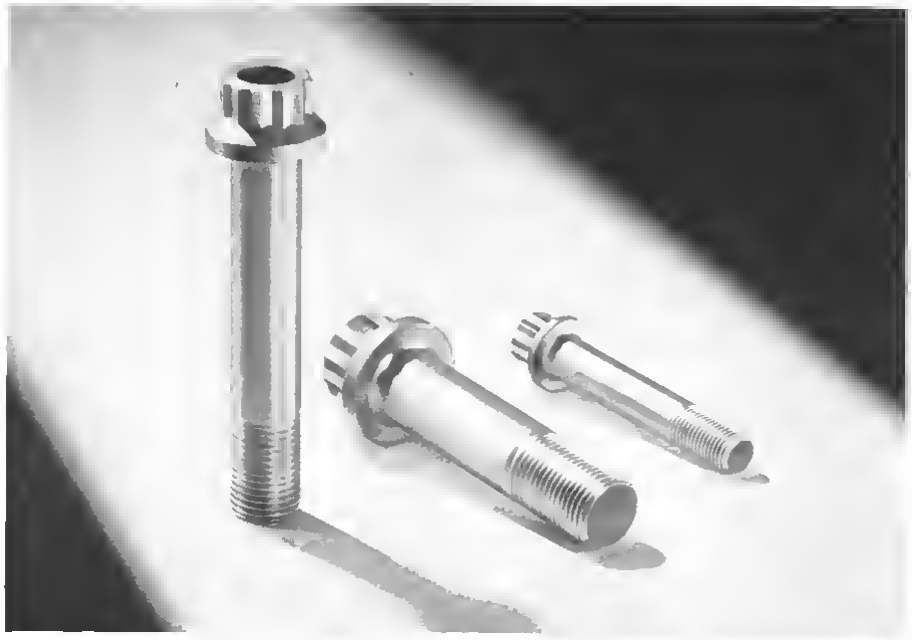
They found, also, that although the missile systems on which they worked were widely divergent in design and purpose, many of the valves involved were first cousins in effect that with modifications a valve designed for one system could be used for another.

It soon became apparent, too, that the effort put into missile valves would in some cases benefit aircraft as new ideas evolved into new systems and new methods of accomplishment.

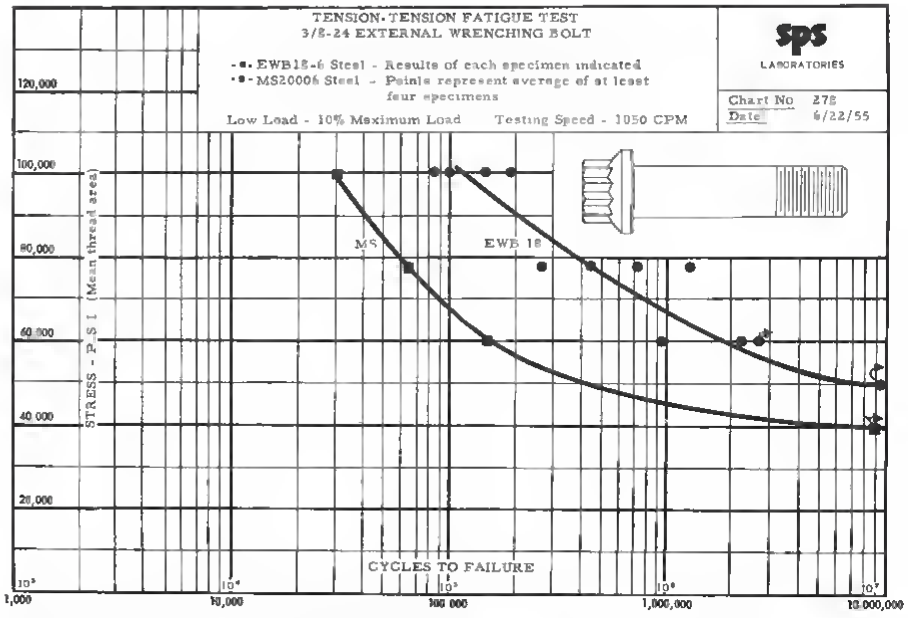
Naturally it followed that Whittaker's research and development work on the various missile projects would be coordinated, channeled in one direction and used for the benefit of all. Refinements and innovations along many lines were made available to everyone to the end that they would help America's overall missile program in the cold war race with Russian accomplishment.

So, to afford specialist attention to a special field, Whittaker has organized a separate missile section. It will be headed by Phil Terry of field engineering, a tall young veteran who talks missile language and knows what he's talking about.

(Advertisement)

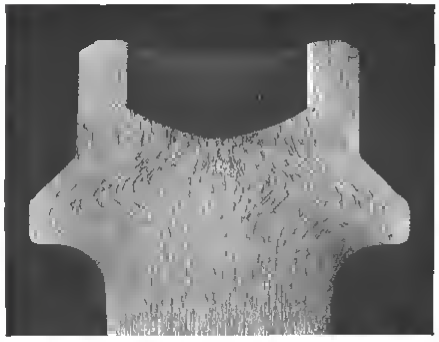


THESE NEW HIGH-STRENGTH EWR-18 TENSION BOLTS developed by Standard Pressed Steel Co combine tensile values of 180 000-200 000 psi with unusually high fatigue resistance Their new type 12-point external wrenching head was specially designed to make maximum preloading torque possible

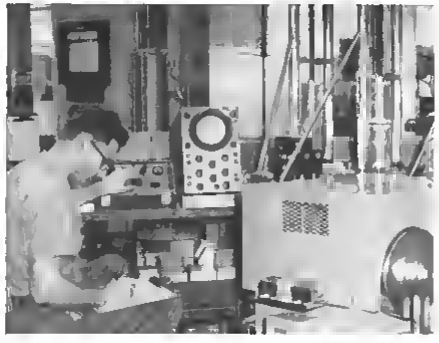


THESE TENSION-TENSION FATIGUE TEST CURVES show the advantage of the EWB-18 over the MS-20004 series under dynamic load conditions The EWB-18 has an endurance limit (maximum load the bolt can endure without failure) of 50,000 psi, compared with 40,000 for the MS-20004 series. Ordinarily greater fatigue strength in a bolt can be obtained only with concurrent reduction in tensile strength The EWB-18 exceeds the MS-20004 series in both tensile and fatigue strength

NEW SPS BOLT SETS TENSILE, FATIGUE



KEY TO EXTREMELY HIGH FATIGUE STRENGTH of the EWB-18 is in the head and fillet of the bolt This critical region is cold worked—forged in such a way that grain-flow lines are continuous and unbroken Carefully controlled manufacturing techniques preserve the flow lines uncut throughout the entire length of the bolt, including the threaded section



THE EWR-18 IS A PRODUCT OF SPS RESEARCH. The data gleaned in the Fatigue Testing Center at SPS—a top-ranking facility in U S industry—have helped SPS metallurgical, design and production engineers produce such firsts as the Hi-Ti bolt (first successful titanium threaded aircraft fastener) and the EWB-18 Stronger, more versatile fasteners are now being developed here

STRENGTH RECORDS

EWB-18 has 20% greater fatigue resistance and 12% greater tensile strength; makes possible smaller, lighter, safer bolted aircraft connections

STANDARD PRESSED STEEL Co was asked to develop a stronger bolt—for use in aircraft still in the drawing board stage The EWB-18 is the fastener SPS designed for the job With this bolt, stronger, lighter joints are possible—flanges and integral structures require less metal. It means weight savings in mating parts as well as savings from use of fewer or smaller bolts.

SPS has complete facilities for developing and producing both standard and special fasteners for use in aircraft engines and in airframes We will share our experience with you in designing threaded fasteners to meet your requirements. Aircraft Products Division, STANDARD PRESSED STEEL Co., Jenkintown 3, Pa

STANDARD PRESSED STEEL CO.

AIRCRAFT PRODUCTS DIVISION SPS **JENKINTOWN PENNSYLVANIA**

MECHANICAL PROPERTIES

	MS 20006	EWB 18-6
Bolt Description		
Type		
Size	⅜ 24	⅜ 24
Material	AMS 6322	AMS 6322
Bolt Strength Pounds		
Ultimate Tensile	15,600	18,375
Yield Strength	12,600	14,800
Material Strength PSI		
252 Gage Specimen		
Tensile Strength	170,000	191,925
Yield Strength	148,000	171,740
Elongation—% in 4 Diameter		
252 Gage Specimen	14.5	14.0
Reduction of Area—%		
252 Gage Specimen	52.4	51.8
Shear Strength—Bolt Body		
Pounds—Double Shear	22,250	25,950
PSI	100,207	117,530
Fatigue Strength @ 2 000 000 Cycles 10% Low Load		
Pounds	3,500	4,380
PSI (minor area)	43 300	54,200
Lot No	12254K47K	29159K48

BEFORE DEVELOPMENT OF THE EWR-18, the strongest standard bolt available to the aircraft industry was the MS-20004 series This table compares the mechanical properties of the old and the new. The EWB-18 is superior in every respect

THREE-AXIS FLIGHT SIMULATOR

Providing a flight table which can be continuously oriented in space with respect to 3 mutually-perpendicular reference axes, the CTI Three-Axis Flight Simulator can be programmed directly from the output of a computer. Operating smoothly with no gearing, the instrument accepts independent voltage signals in each of the 3 axes and converts these ensings into a position corresponding to the defined space vector.

By thus reproducing the conditions of an actual high performance aircraft or missile in flight, the unit expands the capabilities of any testing laboratory. Write for your copy of the descriptive brochure.

SPECIFICATIONS

Roll Accelaration, approx max	40,000 deg/sec²
Pitch Accelaration, approx max	20,000 deg/sec²
Yaw Accelaration, approx max	8,000 deg/sec²
Roll Velocity, approx max	250 deg/sec
Pitch Velocity, approx max	150 deg/sec
Yaw Velocity, approx max	125 deg/sec
Roll Displacemant, max	±120 deg
Pitch and Yaw Displacaments, max	±90 deg
Signal Sensitivity	1.8 deg/volt
Linearity	0.1 %
Servo Accuracy	±0.5 deg
Inertia Load Limit for Flight Table	3 lb-in-sec²
Equipment Test Volume, cylindrical	17-in. diam by 13 in.



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USAF Contracts

Following is a list of unclassified contracts for $25,000 and over as released by Air Force Contracting Offices:

HEADQUARTERS AMC, Wright-Patterson AFB, Ohio

Watson Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark, N. J., indicator ID-351A/ARN, 2608 ea., (PR OC-666455 and MIPR R-58-747-30-AER), $1,151,952.

The General Tire & Rubber Co., 1708 Englewood Ave., Akron, Ohio, nose wheel assemblies for T-33A aircraft, (PR 695786, 696118, 672764), $97,109.

The General Tire & Rubber Co., 1708 Englewood Ave., Akron, Ohio, wheel assemblies for F-100C aircraft (AFA-1215-3A), (PR PE-156207), $28,953.

Fridra Controlling Machine Co., Inc., 2355 Washington Ave., San Leandro, Calif., B-5A drift meters, electrically driven, spare parts and tech publications (RFP R562937-113-Aer), $816,726.

Kearfott Co., Inc., 1150 McBride Ave., Little Falls, N. J., master indicator, 273 ea., controls, directional gyros, 297 ea., repeater indicators, type VIA, 167 ea., amplifiers, 273 ea., controls, slaving, 272 ea., (PR 680386, 597572 and 587572-1), $1,225,053.

General Electric Co., West Lynn, Mass., type E-24 tachometer indicators, Aerna 61-223, (PR 673573), $78,168.

Olympic Radio and Television, Inc., 34-01 38th Ave., Long Island City, N. Y., amplifier synchro signal comparer, 400 cycle, type ME-1, 2776 ea., maintenance data, spare parts and ST&TE, (PR 686401, 457467, 696388 and 673511), $906,224.

Burroughs Corp., 6071 Second Blvd., Detroit 32, Mich., A-4 GBK sights, 215 ea., spare parts, engineering item, (PR 218430 and 218430-1), $1,058,552.

The General Tire & Rubber Co., 1708 Englewood Ave., Akron, Ohio, wheel assemblies for B-52 aircraft, Aerno 61-113, AFA 1164-2, (PR PE-686130), $87,975.

The Goodyear Tire & Rubber Co., Inc., 1144 E. Market St., Akron 16, Ohio, wheel assembly for F-107 aircraft, brake assembly for F-107 aircraft, (PR PE-235870), $28,547.

The Reflectone Corp., Post Road, Stamford, Conn., navigational trainer, dead reckoning, type N-3, (PR 236694), $208,000.

Erco Div., ACF Industries, Inc., Hyattsville, Md., C-123B, type MB-33, flight simulator, maintenance and engineering data, (PR PH-281771), $1,036,343.

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., indicator, oil pressure, type MS 28010-3, Aerno 61-3122, (PR 673-27), $43,670.

General Electric Co., West Lynn, Mass., type MB-6, tachometer generator, (PR 673531), $220,627.

The Magnavox Co., 2131 Bueter Road, Fort Wayne, Ind., spare parts, Inc., (PR PR1080-7), $363,831.

Air Products Inc., Allentown, Pa., facilities for the production of liquid oxygen, (PR 148380), $3,910,000.

Bendix Aviation Corp., Bendix Radio Div., Baltimore, Md., additional facilities for the maintenance and control of the aircraft control and warning system, (PR 580056 and 148903), $118,666.

General Electric Co., Syracuse, N. Y., additional facilities for the maintenance and overhaul of the radar network, (PR 438643), $2,000,000.

Solar Aircraft Co., Des Moines, Iowa, preparing facilities for shipment, (PR 325-664), $160,000.

Curtiss-Wright Corp., Wright-Aeronautical Div., Wood Ridge, New Jersey, preparing facilities for shipment, (PR 671049), $150,000.

Avco Manufacturing Corp., Crosley Div., Cincinnati, Ohio, additional facilities for use in testing MD-1 (MD-4 A-5) flight control systems, (PR 686483), $38,190.

Bendix Aviation Corp., Bendix Products Div., South Bend, Ind., acquisition of additional facilities for J-47 engine components, (PR 185-46), $150,000.

Studebaker Machine and Tool Co., Aviation Div., Rockford, Ill., facilities for production of constant speed alternator drives, (PR 148826), $3,827,025.

Regents of the University of Michigan, Willow Run Research Center, Ypsilanti, Mich., acquisition and installation of facilities for AF R&D contracts, (PR 273760), $50,000.

Regents of the University of Michigan, Ann Arbor, Mich., acquisition and installation of facilities for AF R&D contracts, (PR 273766), $49,000.

General Electric Co., Syracuse, N. Y., design and engineering of buildings in support work on a missile guidance system, (PR 14-910), $80,000.

Erco Div., ACF Industries, Inc., Hyattsville, Md., C-122B, type MB-33, flight simulator, maintenance and engineering data, (PR PH-281771), $1,036,343.

Sinmacra Gyroscope Co., 332 E. Broadway, Santa Monica, Calif., indicator, directional gyroscopic, Type C5C, Aerna 60-6201, 1668 ea., (PR MA-599434, PE-673547 and MA-597830), $858,670.

Chicago Aerial Industries, Inc., 1000 Hawthorne Ave., Melrose Park, Ill., Type A-26 magazines, aircraft camera, C-8P-2026, 254 ea., (PR 143018), $226,320.

North American Aviation, 12214 Lakewood Blvd., Downey, Calif., magnetic tape recorder, RO-14/APH, 242 ea., maintenance spare parts, bulk, various data, 1 set, (PR 580139 and 580139-1), $979,100.

Webster-Chicago Corp., 816 North Kedzie Ave., Chicago, Ill., Receiver-Transmitter, RT122/APW-11, 1368 ea., dynamotor unit DY-89/APW-11A, 932 ea., selector unit C-406A/APW-11, 1306 ea., maintenance spare parts, bulk (PR FL-159218), $1,113,133.

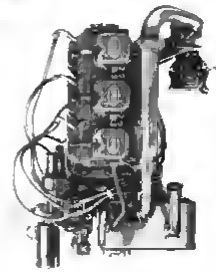
Nelleon Cash Register Co., Main and K Sts., Dayton 3, Ohio, 30 RVA, constant speed drives, 14 ea., (PR 6356071), $280,280.

Bendix Aviation Corp., Scintilla Div., Sidney, N. Y., selector panel, Aerno 61-1020, 113 ea., filter, Aerno 61-1026, 1105 ea., (PR 686210), $86,920.

Bendix Aviation Corp., Eclipse-Pioneer



This is the name you see on 75% of all the helicopters flying today



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AIRCOOLED MOTORS, INC.
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There is no substitute for experience—and Franklin has more of it! Every year since 1939, far more Franklin engines have been chosen for helicopter power than any other kind in their power range. Industry figures show that 4 out of 5 helicopters under 400 h.p. built in 1955 had power by Franklin. Why this preference? Because no other engine can match Franklin's record for reliability with low operational and maintenance cost. Specify Franklin power in your next helicopter under 400 h.p.

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We can now accept additional subcontract work similar to that long produced for major companies in the aircraft field. We are fully equipped for quantity production of precision machining and subassemblies of highest quality. Your inquiries are invited.

Franklin POWER

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Gyros

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QUALITY ABOVE ALL!



HIG-3, Model 2 GYRO, Now Available!



DATA

1. Spin Motor: 3 Volts R.M.S., 400 Cycles/second, 2 phase
2. Power Required: .75 Watts Maximum.
3. Synchronous Speed: 12,000 R.P.M.
4. Run-up Time: 10 Seconds Maximum
5. Angular Momentum: 10^3 Gram Centimeter^2/second
6. Gimbal Travel: ±6° Maximum
7. Signal Generator Sensitivity: 8 Millivolts/Milliradian, with 25 Milliampere, 400 Cycles/second excitation
8. Signal Generator Linearity Deviation: ±1%.
9. Torque Generator Excitation: 50 Milliamperes, 400 Cycles/second
10. Torque Generator Linearity Deviation: ±1%
11. Input Rate: 2 Radians/second Maximum
12. Null Voltage: 1 Millivolt Maximum.
13. Characteristic Time Constant: .002 Seconds
14. Drift Rate: .005 Milliradian/second
15. Heater Power Warm-up 60 Watts, running 15 Watts, 115 Volts, 400 Cycles/second
16. Weight: 4½ ounces
17. Single Degree of Freedom.
18. Viscous Damped

NOTE: *This Gyro can be readily modified to meet your requirements. We invite inquiries listing specifications.*

The Greenleaf Line of Gyros and associated devices is being steadily expanded. It now includes a wide selection of Rate and Rate Gyros, and the HIG-4 Gyro.

Write, wire or phone for further information.

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Producers of the HIG-3 and HIG-4 Gyros, Rate and Free Gyros, Differential Pressure Mach Meters, Air Speed Indicators, Computers, Switches and many other precision-built components.

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Div Teterboro N J Industrial In flight refueling Type MA 9 604 ea amplifier In flight refueling Type MF 1 604 ea (IR 046786-C 2 and C 41 $806 302

Lear Inc., Lear-Romec Division Elyria Ohio pressurizing equipment (PR 235887 235886 235888 235846 581252 and 581252-1) $116 710

Jack & Heintz Inc., Cleveland 1 Ohio generators engine driven 30 volt 300 amp Aernc 42-7010 and 42-6805 (PR PR 641569 and MIPR 578632) $145 553

Bendix Aviation Corp., Bendix Products Div South Bend 20 Ind brake assemblies Aernc 41 7271 APA 1202 2A 1269 ea wheel assemblies, Aernc 41 7370 AFA-120-3C 430 ea (PR 235682 and 236811 $184 920

Collins Radio Co., 855 35th St Northwest Cedar Rapids Iowa radio receiving R-540/ARN 14C 7511 ea dynamotor DY 685/ARN 11 169 ea (PR 168019 158426 158424 642852 and MIPR R55 2736-21 AFR) $3 101 445

General Electric Co., 1086 Western Ave West Lynn Mass power supply in-flight refueling type MC 1 Aerno 91-1051 288 ea (PR 615904) $15 200

Andrea Radio Corp., 27 01 Bridge Plaza North Long Island City 1 N Y control panel C 825/AIC-10 461 ea control panel C 824/AIC 10 6844 each relay assembly RE 94/AIC-10 533 ea (PR 168003 165230 165006 561187 645858 MIPR R55 1028 31 and R56 744-26 $1 756 527

Librascope, Inc., 808 Western Avenue Glendale 1 Calif photo reconnaissance transposer and digital computer test equipment spare parts drawings and reports (PR 1276) $85 000

Continental Aviation and Engineering Corp., 12700 Kercheval Ave Detroit Mich AJ89 T-17 engines data (PR 236421 and 236421-1) $331 863

Western Electric Co., 120 Broadway New York 5 N Y components of radar set AN/APS-64 (PR 709615 and 709817) $1 591 295

Motorola Inc., 2710 North Clayburn Ave. Chicago Ill components of radar set AN/APS-64 (PR 709815 and 709821) $1 14 739

American Bantam Car Co., 152 Mac question Parkway South Mt Vernon N Y mounting MT-272/ARN-6 radio compass (PR SB-46463-a MIPR R 56-743-24 AER GE-181437) $76 436

Olympic Radio and Television Inc., 34 01 38th Ave Long Island City 1 N Y Receiver transmitter RT 316A/APN panels control SB 315/APN-70A mountings MT-1283A/APN 70 (PR 168728 168956) $331, 672

Navy Contracts

Following is a list of unclassified contracts of $25 000 and over as released by Navy Contracting Offices

BUREAU of AERONAUTICS Washington 25, D C

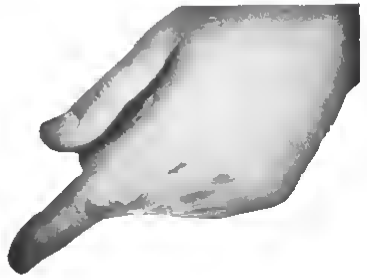
Bendix Aviation Corp. (Eclipse-Pioneer Div.) Teterboro N J accelerometer R8SAO140-050-606 NOas 56 387 f (FD 42-1130 56) 3500 $287 980

Computer Control Co. Inc. 92 Broad St Wellesley 57 Mass. preparation of problems for raydac computer operation of computer maintenance of computer and repair NOas 56 466-c (EL-78-2744-56), $371 693

Curtiss-Wright Corp. (Wright Aero. Div.) Wood Ridge N J. modification of government-owned J65 W-4/W 16 turbo jet engines NOas 56 531-f (PD 41 3457 53)-50 $119 266

Flight Refueling Inc. Friendship International Airport, Baltimore 3 Md services of (a) factory trained flight refueling field service technicians to instruct Naval and Marine Corps personnel in the field in the operation servicing and maintenance of flight refueling equipment NOas 56-759-c (NIA-33-4448-56) $78 246

Admiral Corporation, 3800 Cortland St. Chicago 47 Ill APG-59A Receiver-transmitters and components NOas 56-315 (PD-31-2631-55), 1280 $1,785,645



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AT YOUR FINGER TIPS, issue after issue, is one of your richest veins of job information – advertising. You might call it the "with what" type – which dovetails the "how" of the editorial pages. Easy to read, talking your language, geared specifically to the betterment of your business, this is the kind of practical data which may well help you do a job quicker, better – save your company money.

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Microscopic inspection of races, one of more than one hundred operations undertaken to insure the highest degree of uniformity and dependability.



Super-cleanliness is a byword in this ball bearing assembly and inspection area. It is completely air-conditioned and pressurized to keep out dust.

Volume source for *miniature* ball bearings!

These tiny steel "jewels" are available in a complete line, 3/8" (.375") outside diameter and smaller. They are made with super-accuracy on the finest equipment available—much of it designed by New Departure—to meet the most exacting requirements of today's precision industries. Performance and dependability of the highest order are assured.

For complete information about miniature ball bearings, or for help with any bearing problem, call on New Departure's expert engineering service. New Departure, Division of General Motors Corporation, Bristol, Connecticut.

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GM GENERAL MOTORS

NEW DEPARTURE

BALL BEARINGS

NOTHING ROLLS LIKE A BALL

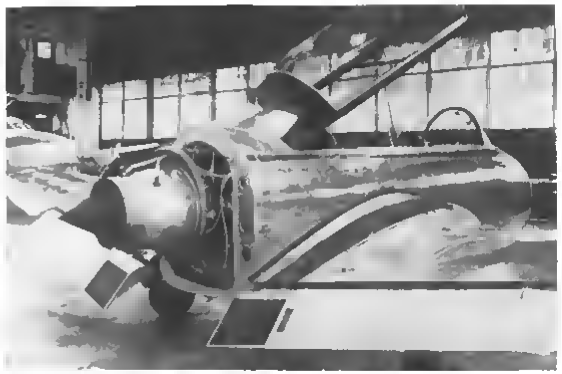




DURING TESTS, Jet Mentor underwent high angle climbs (above) vertical dives (right)

Beech Jet Trainer Tested By Navy





JET MENTOR COCKPIT (above, left) is roomy, has good visibility. Continental J69 I 9 jet is reached by splitting fuselage





NAVY AVIATION ELECTRICIAN and G-E "tech rep" check out flight stabilization system on Chance Vought F7U-3 Cutlass

How on-the-spot service engineers back up General Electric flight control systems



G-E SERVICE ENGINEER, Willie Jaques, demonstrates the auto-pilot line maintenance tester to Navy aviation specialists

G-E field service engineers provide valuable technical assistance to the Armed Forces wherever service is required on General Electric flight control systems. These "tech reps" also conduct classes for pilots and aviation specialists on the operation and maintenance of G-E flight control systems.

In addition, General Electric service engineers make detailed field operation reports on flight control system performance. These reports provide design engineers with information on system performance on operational aircraft for improving future G-E flight control systems—systems that are now being designed and built for the latest supersonic aircraft.

FOR DETAILED INFORMATION on the flight control systems that General Electric is designing and manufacturing for our Armed Forces, contact your G-E Aviation and Defense Industries Sales Office, Section 221-9, Schenectady 5, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Sales Will Exceed $100 Million in 1956

By Erwin J. Bulban

First quarter shipment reports indicate that U. S. business aircraft manufacturers will probably deliver over 6,500 airplanes worth more than $100 million. Last year's shipments were approximately 4,500 planes valued at about $70 million.

An AVIATION WEEK survey of leading manufacturers shows that backlogs ensure steady high-level production through 1956, in some cases they will be responsible for expanding facilities to keep pace with demands.

Business and utility aircraft manufacturers shipped over 600 aircraft in March at a total net billing exceeding $9.4 million. Total deliveries for the first quarter of 1956 were a record 1,632 planes valued by the factories at more than $25 million.

The Big Three—Beech, Cessna and Piper—handled the lion's share. In March, they shipped 575 aircraft worth more than $8 million, in the first quarter of 1956, they delivered 1,632 planes worth better than $22.1 million. In the same three months last year, the three manufacturers delivered 1,072 planes valued at slightly more than $15.6 million.

Cessna is maintaining its early lead over Beech and Piper and is expected to lengthen it as a result of anticipated increases in Model 172 and 182 sales. These models, introduced this year, will probably far outsell the previous versions with conventional landing gear. This was Piper's experience when it switched to tricycle landing gear on its four-place Pacer. Early public reaction to the new Cessna tricycle models confirmed indications that there is an overwhelming demand for this type landing gear on business aircraft.

Big Backlogs

The business volume currently on the books of the top-ranking business plane manufacturers indicates the prosperous state of the industry.

In most cases deliveries of new business planes are booked well into the summer and fall, but the manufacturers emphasize that this backlog does not mean customers will have to wait this long to have their orders filled. Under modern merchandising, most distributors "floor plan" their inventories to have airplanes continuously available, if they run out they often fill the order by getting an airplane from another distributor.

Beech Aircraft Corp. reports that as of Mar. 31 it had a firm backlog (with cash deposits) for 286 airplanes having a total manufacturer's billing value of $10,511,880 and an estimated retail value of $16,714,000. The breakdown by model: Twin Beech E18S, 62; Twin Beech D18S, 5; Twin Bonanza D50, 47, Bonanza G35, 144, and Mentor B45 trainers for export, 20. In addition distributors had placed orders pending deposits to assure themselves of positions on monthly delivery schedules, estimated at $10,826,065.

In 1956 Beech calculates that it will deliver 755 commercial airplanes having a total retail value of $38,925,000 including 100 E18S, 5 D18S, 150 Twin-Bonanzas, 500 Bonanzas and 20 Mentor trainers.

Current delivery dates, from factory to distributor: Beech E18S, Aug. 31, Twin-Bonanza, Aug. 13; Bonanza, July 16.

Beech plans no expansion in its current employment of about 6,000; it is planning to spend approximately $500,000 in expansion of plant area, tooling and machinery.

Cessna 310 twin-engine production is sold out through October 4. At the present rate of one airplane per working

U. S. BUSINESS & UTILITY AIRCRAFT SHIPMENTS

(January—March 1956)

	Aircraft		Builder's Net Billing Price	
	Mar	Jan.-Feb Total	Mar	Jan.-Feb Total
Aero Design 560-A	4	16	$652,000	$1,087,700
680	4	0		
Beech Bonanza	46	84	2,556,212	4,232,696
Super 18	8	13		
D18S	2	0		
Twin-Bonanza		21		
Callair A-5A		0		
A-4	1	4	7,000	11,008
Camair 480 Twin-Navion	0	7	0	269,000
Cessna 170	6	26	3,611,878.91	6,102,052.78
172	148	282		
180	63	180		
182	78	0		
310	21	43		
325[1]	1	0		
Champion	14	24	56,000	112,500
Helio H-3918 Courier	2	5	46,000	116,000
Lear Learstar Mk. 1	1	1	400,000	400,000
Mooney Modal 18	3	0	79,451.35	61,539.50
Modal 20	7	6		
Piper Super Cub PA-18	18	39	1,863,948	3,817,390.65
Super Cub PA-18A	46	89		
Tri-Pacer PA-22	94	209		
Apache PA-23	34	71		
Royal Gull P-136L	2	4	149,000	298,000
Taylorcraft Tourist 15A	0	0	36,000	37,153.80
Modal 20	4	4		
Totals	607	1,128	$9,457,490.26	$16,545,040.73

[1] Agricultural version of L-19.
Source: Compiled by AVIATION WEEK from manufacturer's reports. Previous tabulations for 1956: AW Apr. 2, p. 67; AW Mar. 19, p. 63.

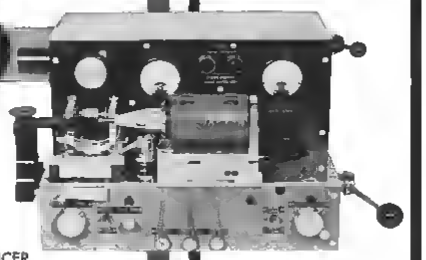
Locates Measures Corrects

Detailed information is in Instrument Data Sheet 211, available upon request to Technical Literature Section.

DYNAMIC UNBALANCE

of high speed rotors to better than .00001 inch-ounce

decker **DYNAMIC BALANCER**



without removing the rotor from the mount

The DECKER DYNAMIC BALANCER offers, on a single portable chassis, the complete requirements for precision dynamic balancing. The necessary equipment for rotor mounting, measurement and location of unbalance, plus a precise metered automatic drill for unbalance correction, are included.

- Maintains laboratory type precision balance on a production basis
- Does not require a skilled technician
- Automatic marking of point of unbalance
- Drilling performed without removing rotor.
- Precise indication of degree of unbalance
- Automatic speed control
- Rapid run up to proper speed
- Completely self contained and portable (11" x 15" x 21")
- Rapid work change over

Designed specifically for high speed rotors where maximum possible precision of balance is required, the Model 211 Dynamic Balancer is capable of handling any rotor which may be electrically driven at 10,500 rpm or higher.

The many features of the Decker Dynamic Balancer permit rapid instruction of unskilled personnel in its use. Among these features are automatic location and marking of the point of unbalance with precise visual indication of the degree of unbalance.

decker AVIATION CORPORATION

1361 Frankford Ave., Philadelphia 25, Pa. PHONE GArfield 5-2300

day, the backlog on this particular model is well over 100. Average 310 retail price is $60,200. Earliest delivery date for the 310 is October 5.

On its four place 170 and 180 series, the company is not scheduling any orders beyond three months. Each Cessna dealer estimates the airplanes he will need during a 90-day period and places signed orders and deposits for this amount. Each succeeding month, he submits a report for the third 30 day period and the company plans its production on the basis of these orders and evens off production peaks and valleys.

Present single-engine aircraft output is 12 airplanes per day. Average price of these airplanes: Model 170, $9,350; Model 172, $9,325; Model 180, $14,250 and Model 182, $15,000.

If business continues at the current rate, Cessna says that it will probably have to expand to meet customer demands. Definite decisions have not been made pertaining to increasing facilities, employes or shifts. The assembly line currently operates one shift with a second shift handling subassembly and fabrication of parts to keep well ahead of final assembly.

Piper Expands

Piper Aircraft also has an impressive backlog, 202 Apache twins, 378 Tri-Pacers, 13 PA-18 "95s", 35 PA-18 "150s" and 146 PA-18A agricultural airplanes, involving $12,663,789 in orders. Earliest delivery date on new orders for PA-18s, PA-18As and Tri-Pacers is Sept. 1. Some of these orders are for stock and if one dealer runs short he generally can get an airplane from another dealer to deliver to a customer. Earliest delivery date for the Apache is Oct. 2—all backlog orders require a deposit of $2,500. Company officials estimate that Piper will build 2,262 business and utility aircraft this year, last year it delivered 1,870 units.

Piper's current expansion program involves a $1 million expenditure, including the new 60,000 sq. ft. production area which will soon go into operation for increasing Apache output to two planes daily. The company will soon begin another 400 ft. addition to one of the plant's east assembly wings to facilitate detail work during flight test period, compass swinging and other final operations.

The two plant additions will increase production areas by 100,000 sq. ft. bringing Piper's total manufacturing space to more than 424,000 sq. ft. Current employment is 1,500. Another 500 employes will be added when production of the new all metal, low-wing Commanche gets into full swing next year. Final assembly department is working a single shift; fabrication departments are on two shifts.

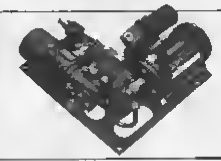
PRESSURIZE ELECTRONIC EQUIPMENT with Eastern UNITS

The extensive line of Eastern Pressurization Units for airborne electronic equipment accommodates a broad range of requirements, and meets appropriate government standards.

Units can be modified to meet your specific requirements. These modifications usually consist of: 1) Different compressors, 2) Motor change to meet your requirement, 3) Change in pressure switch settings, 4) Different mounting provisions. Eastern welcomes the opportunity to discuss and quote on your particular application problem.

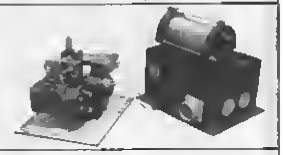
MODEL E AP-100 TYPE 202

- Maintains system pressure of 25 PSIA minimum
- Motor is 0.3 HP—10,000 R.P.M., 208 V., 3 ph., 800 cy.
- Current draw is 7 amperes/phase maximum under normal operating conditions
- Unit operates continuously
- Weight is 4¾ lbs. maximum



MODEL E/AP-150 TYPE 205

- Operating pressure switch maintains system pressure of 17 PSIA
- Motor is 1/25 HP 7,800 R.P.M. 27 volts D.C. —TE89
- Current draw is 2.0 amperes maximum under normal operating conditions
- Life is 800 operating hours
- Weight is 8 lbs. maximum



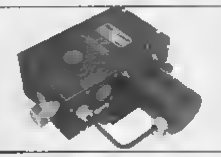
MODEL E/AP-1500 TYPE 203

- Operating pressure switch maintains system pressure of 30 PSIA
- Motor is 1/15 H.P. nominal 24-28 volts D.C. 5,000 R.P.M. continuous duty shunt wound
- Current draw is 3.4 amperes maximum under normal operating conditions
- Life is 500 operating hours
- Weight is 12 lbs. maximum



MODEL E/AP-2400 TYPE 201B

- Maintains system pressure of 31 PSIA
- Motor is 1/10 H.P. 24-28 volts D.C., 5,000 R.P.M. continuous duty
- Current draw is 5.5 amperes maximum
- Life is 800 operating hours
- Weight is 10-3/4 lbs. maximum



MODEL E/AP-3600 TYPE 200

- Maintains system pressure of 31 PSIA
- Motor is 1/7 H.P. 10,000 R.P.M. { 208 V., 400 cy.—3 ph / 24-28 V D.C. } continuous operation
- Current draw is { 1.3 amp./phase / 7 f on D.C. } amperes maximum under normal operating conditions
- Life is 1,000 operating hours
- Weight is 8-1/2 lb. maximum



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The work includes all MIL-E-5272 environmental tests on a wide variety of mechanical, electrical and pneumatic components used in the very latest rocket propulsion systems—a fascinating field, where the future leads you in only one direction: upward!

Superior working conditions, fringe benefits. Ideal Southern California climate.

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Now!... the NEW ROBINSON WIRE TWISTER with DIAGONAL GRIP-HEAD



Faster, more efficient than ever! The new, slendernose DIAGONAL GRIP-HEAD is designed especially for those narrow-hard-to-reach places. Split-second whirling action safety-wires 3 engines in time required for one by any other method . . . saves as much as $140 per engine assembled.

3-TOOLS-IN-1 . . . pliers-cutters-twisters. Side-cutting, oil-tempered head. Permanent bronze bearing. No adjustments. Jaws lock on wire, can't slip off. Perfect, uniform twist every time.

12" —for assembly line safety wiring. 15 oz. **$21.50**

9" —for bench work, sub assemblies. 12 oz. **$20.50**

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We are engaged in several long range research and development projects involving original and analytical work, correlation with experimental test evaluation of flight test results. Prefer man with B.S. degree in Aeronautical Engineering and minimum of five years experience primarily in the helicopter field.

This is interesting work offering opportunity to engage in fields of high speed helicopter flight, flying qualities, and design optimization of geared and pressure jet helicopters. Ideal working and living conditions. Salary commensurate with ability and background.

Write or wire (collect)
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AIRCRAFT DIVISION
Culver City, California

Range-Forest Spray Gained 13% in 1955

Approximately 5 million acres of range and forest land were treated by aerial applicators last year, a 13% increase over 1955. Spruce budworm, grasshoppers, Mormon crickets and gypsy moths were the major targets.

About 1 million acres of timber will require spraying this year, in addition to 1.5 million acres of Northeastern U.S. infested with gypsy moth and approximately 20 million acres of grasshopper infested range lands in 16 western states.

Liability-Coverage Proof Proposed for Aircraft

Washington—All civil-aircraft operators would be required to give proof of their ability to assume any damages they might cause under legislation introduced by Rep. Herbert Zelenko (D-N.Y.).

The proof would be by "bond of a surety company, a policy of insurance or such other assurances as the board may prescribe. Thousands of our citizens have been maimed and killed, and their property destroyed in accidents involving the use of privately owned airplanes," Zelenko said. "Adequate compensation for such damage has not been forthcoming due to the fact that many private owners are not financially responsible. This has resulted in economic privation and the permanent suffering of the victims of these accidents who have found themselves with uncollectible judgments or claims."

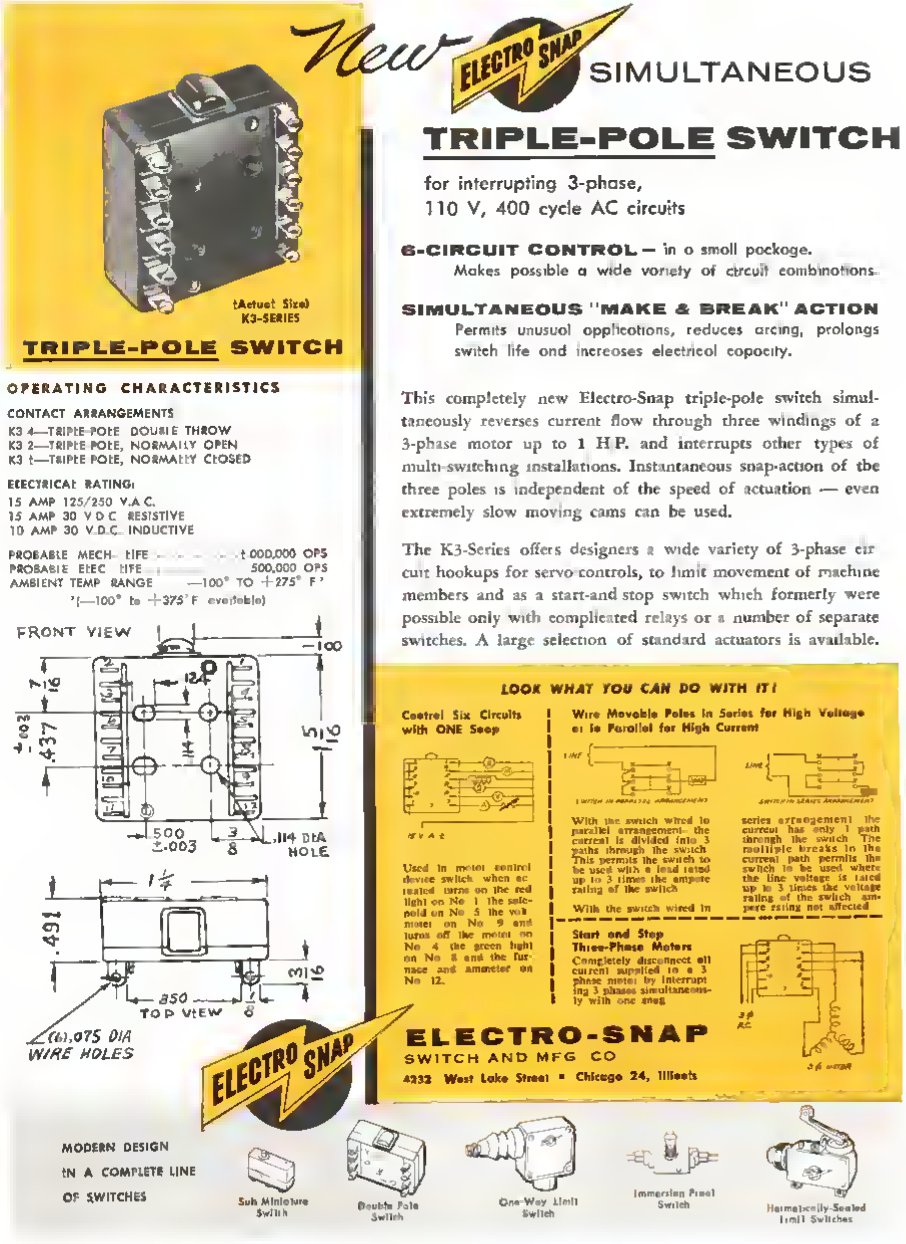
PRIVATE LINES

New Temco 51 primary jet trainer (AW April 2, p. 27) has been inspected by Col. J.S. Pirruccello, chief of the cargo and trainer branch, USAF Air Materiel Command.

Air Fair at Morristown (N.J.) Municipal Airport plans to exhibit business aircraft, accessories, helicopters, military equipment, antique aircraft and automobiles. Date: May 20.

Grumman G-21 amphibian wing panel rework replacing all fabric with aluminum covering has been approved by Civil Aeronautics Administration-CAA supplemental-type certificate SA1-3 has been awarded Mattituck Air base Corp., Linden, N.J., which engineered the modification. Method replaces existing wing rib cap strips, there are no access openings in top or bottom skins and all joints and laps are sealed.





CAB Report on Beech Bonanza Crash in Hollywood

Wing Failure Followed Loss of Control

At 2214,[1] on October 17, 1955, a Beech Bonanza, Model C-35, N 5825C, piloted by Joel W. Thorne, crashed into an apartment building located at 11948 Magnolia Boulevard, North Hollywood, California.

Eight residents of the building and the pilot were fatally injured, one resident was seriously injured. The building received major damage and the aircraft was destroyed by impact and the fire which followed.

At approximately 2100 October 17, Pilot Joel Thorne telephoned the Burbank CAA Airways Communications Station and filed a DVFR (Defense Visual Flight Rules) flight plan from the Lockheed Air Terminal, Burbank, California, to McCarran Field, Las Vegas, Nevada.

The flight plan specified a proposed routing over Airways Amber 1 to Newhall, Green 4 to Palmdale and Daggett, and Amber 2 to Las Vegas. Pilot Thorne estimated he would depart at 2115 with no passengers and the flight would require approximately one hour and 40 minutes. He also indicated his aircraft—a Beech Bonanza N 5825C (referred to as N 25C), had sufficient fuel for four hours of flight.

Weather Conditions

At this time and for about two hours thereafter the Lockheed Air Terminal weather conditions were reported as: Ceiling 700 feet overcast, visibility 2 miles in smoke and haze, top of the overcast reported variable 2,500 to 3,000 feet msl (mean sea level) or 1,800 to 2,300 feet above the ground. In conversation with a pilot who had just landed Mr. Thorne was advised of these conditions.

At 2159 Pilot Thorne radioed the Burbank Tower (located at the Lockheed Air Terminal) from N 25C and asked for taxi and takeoff instructions. In response the tower local controller cleared the flight to runway 15 (150 degrees magnetic) and gave the latest wind and altimeter information.

When asked if he was IFR (Instrument Flight Rules) or just a climb to on top Mr. Thorne replied he just wanted a clearance to climb westbound to on top. The controller then transmitted "N 5825C, Burbank Tower, you can have a southeast reversal immediately or a six-minute delay for a 260 degree departure." Pilot Thorne elected the latter.

At 2208 the controller cleared the flight as follows: "Bonanza 25C taxi into position and hold. You climb out after takeoff make right turn, climb on magnetic heading of 260 degrees to on top, report on top." This was acknowledged by Mr. Thorne.

[1] All times herein are Pacific Standard and are based on the 24-hour clock.

The takeoff appeared normal to the tower personnel and they noted the navigation and two anti-collision lights (Grimes lights) on the Bonanza were on throughout this time. The Bonanza was last observed from the tower turning right and climbing toward the overcast. There were no other radio contacts with the flight.

Shortly thereafter the Burbank controllers received several telephone calls from residents south and southwest of the airport. They reported an aircraft in that area was flying very low and appeared to be in trouble or stunting. At 2214 an aircraft later identified as N 5825C crashed into an apartment building 4.3 miles southwest of the airport.

INVESTIGATION

Many ground witnesses located south and southwest of the airport saw and/or heard N 25C in flight before it crashed into the apartment building. A representative group of these witnesses testified at the Board's public hearing concerning their observations and many others furnished factual statements during the investigation.

From this source of information the probable flight path of the aircraft was reconstructed as accurately as possible and is shown as attachment A.

The first of these witnesses an aircraft mechanic employed at the airport, was located on Riverton Avenue near Victory Boulevard. Interested in the anti-collision lights which he had observed being located on N 25C during the day he went outside of his home to see them when he recognized the sound of a light aircraft engine and thought it might be Mr. Thorne taking off.

The witness saw N 25C immediately after takeoff as it turned right to an approximate heading of 260 degrees. On this heading it continued to climb and entered the overcast over the vicinity of Victory and Vineland Boulevards. Shortly thereafter the witness heard the engine sound get louder and in a manner which gave him the impression the aircraft was turning left and descending rapidly.

The Bonanza was then seen to emerge from the overcast at very high speed diving steeply and turning left. The nose of the aircraft jerked up sharply while the turn continued through north to a west heading completing one 360 degree turn from the first observed direction. The aircraft again disappeared into the overcast climbing steeply. This witness, because of his interest in the anti-collision lights, stated positively that they were on while he could see the aircraft. The witness continued to hear the aircraft but could not see it again.

The second witness, a pilot, was located west of the first. He stated that N 25C was observed to pass closely over his position three times while it flew a circular path, approximately one-half mile in diameter, bounded by Victory Boulevard on the north, Cahuenga on the east, Tujunga on the west and, although beyond his vision, probably Magnolia on the south. During this time he observed the aircraft climb into and dive out of the overcast several times. He stated these erratic movements seemed to indicate the pilot was having difficulty with lateral and longitudinal control.

This witness, in agreement with the first, thought the engine sound increased and decreased with vertical oscillations of the aircraft. The engine sounded as though it were operating with an appreciably high power setting and with its propeller in fairly low pitch. The engine sound however was uninterrupted and did not indicate any malfunction.

This witness observed that the navigation lights were on but said the anti-collision lights were off. No witnesses after the first observed the latter lights to be on. When the Bonanza passed the witness the third time it assumed a westerly heading and again climbed into the overcast.

Dives and Climbs

Next to see the Thorne aircraft were several witnesses located more than one mile southwest of the first two and slightly less than one mile north-northeast of the accident site. They also described the rising and falling engine and propeller noise and those who saw the flight observed it go in and out of the overcast.

One witness, with dive bomber experience, said the sound was unmistakably that of an aircraft diving and pulling up. In this area the Bonanza again flew at least one complete 360 degree circuit path.

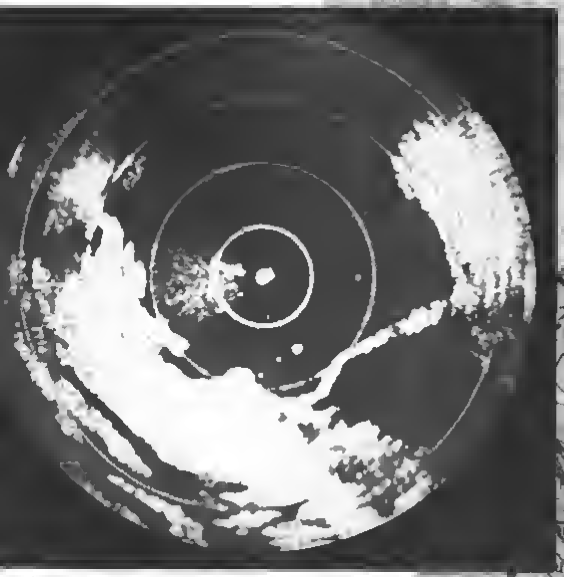
Witnesses in the immediate accident area who saw the crash stated that just prior to the accident the aircraft dived out of the overcast at an estimated 65-75 degree angle on a southeast heading but turning rapidly to its right. It pulled up sharply when it reached a southwest heading at which time several large components separated from the main aircraft structure.

Rolling violently to the right the major structure plunged into the apartment roof. An explosion and intense fuel fire followed.

Nearly all witnesses were in agreement that weather conditions observed along the flight path of N 25C corresponded with those reported at the Lockheed Air Terminal. Many stated the overcast was without breaks and fairly smooth along the bottom. Several stated this ceiling was at least 700 feet above the ground and visibility at least two miles with little variability.

The aircraft structure available for ex-

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Circled portion of navigational chart as seen on scope of AVQ-10 radar, inboard antenna (Note Heyward San Mateo County bridge)



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ammation was greatly limited major portions of fuselage left wing and cockpit having either been consumed by fire or burned nearly beyond recognition. However, major portions of the right wing, right flap and aileron together with the empennage were found at varying distances up to several hundred yards northeast of the main wreckage site. This was confirmation that the aircraft had sustained an inflight failure of its basic structure.

The right wing was relatively intact and had received only moderate impact damage. The primary failure of this wing occurred just outboard of the wing to center section attachment in upward or positive bending as a result of loads in excess of the strength of the structure.

Chordwise compression buckles were evident on the upper wing surface outboard of the primary fractures. In addition numerous diagonal wrinkles were found on both the upper and lower surfaces of this wing. The type and direction indicated these were produced by a high nose down torsional load on the wing box structure.

Inflight Structural Failure

As indicated, the right aileron and a major portion of the right flap separated in flight. Evidence clearly showed they were torn from the wing by forces in excess of their strength. The twin inboard flap hinge ribs had been torn from the flap but remained in place in the wing. These were found jammed in the flap's retracted position.

This flap position was further verified by comparing the flap drive screw extension of N 25C with that of another Bonanza with flaps retracted. The right aileron failed and separated in three sections. Evidence showed that before separation the aileron had been positioned well past its normal down travel.

The left and right tail sections showed no evidence of fire or that they had been struck by any other component of the aircraft. The primary inflight failures of both occurred at the spar to fuselage attachment. Both failures were similar except the right section failed upward under positive loads while the left failed downward under negative force. These failures indicated violent right rotation of the aircraft along its longitudinal axis following the right wing separation.

The right main landing gear was found relatively undamaged in the fully retracted position. Thus, together with the position of the landing gear drive mechanism showed that the landing gear was retracted at the time of the accident.

Numerous metal samples from the available structure were examined by metallurgists under laboratory conditions. Results of this examination disclosed that the material was within the specification limits and there was no evidence of fatigue failure.

The Beech model C 35 is type certificated under the "Utility Category" strength requirements of Part 3 of the Civil Air Regulations and the approved operating limitations for this model are set forth in Aircraft Specification No. 777 issued by the Civil Aeronautics Administration.

Since an inflight structural failure of the airframe had occurred in this accident, a review of the design data was made by Board investigators. This review showed that the structural design met, and in many instances exceeded, the minimum strength requirements of Part 3. It also showed the adequacy of the design was thoroughly verified by extensive laboratory testing.

Because the wing failure of N 25C appeared to have resulted from a rolling pull out type of loading, the Board requested the airframe manufacturer to provide data on the airframe strength for this maneuver. The manufacturer's report submitted as an exhibit at the public hearing, indicates that the wing design incorporated strength for an ultimate load factor of from 5.25 to 5.80G, as compared with required minimum strength of 4.4G.

The engine a Continental model E-225-8 received major damage at impact and from the intense fire which followed. The engine was disassembled and examined in detail to determine whether or not its malfunction or failure was a factor in the accident. The reciprocating assemblies, drive gears, bearings and bushings were intact and did not show evidence of operating distress. The cylinder assemblies indicated no combustion chamber difficulties.

As a result of this investigation there was no evidence found to indicate that there was a malfunction or failure of the aircraft powerplant.

The propeller installed on N 25C was a Beech model 215109. Both blades were bent rearward with considerable amounts of each outboard end melted away by the fire. The pitch-changing mechanism and motor were intact with the motor still attached to the propeller ring gear.

A measurement of the pitch-changing motor pinion gear from the low pitch stop revealed the propeller blades were positioned about 18 degrees. This position at cruise climb would maintain 130-140 miles per hour. There was no evidence of malfunction or failure of these components.

Pilot's Record

The official airman records of the CAA showed that Mr. Thorne began his flying career in 1933 and received a private pilot certificate in 1935. Thereafter on January 13, 1938, he was issued a commercial pilot certificate at which time he had 459 flying hours. He applied for and was reissued a commercial pilot certificate on February 13, 1953.

The application for this certificate submitted by Mr. Thorne listed his total flying time as 3,300 hours. On June 30, 1955, he applied for a medical certificate and listed his total flying hours as 3,800. He also showed that of this time 800 hours were actual instrument, 45 were hooded instrument flight and 45 were simulated instrument. He listed 600 hours of the 3,800 as flown at night and 60 as accumulated within the preceding 12 months. The records disclosed that Mr. Thorne did not hold an instrument rating.

Pursuant to the medical application Mr. Thorne was examined and issued a valid second-class medical certificate dated June 30, 1955. The terms of the certificate required him to wear minor corrective lenses while flying, there were no other waivers. Board investigators were unable to find any substantiating personal records to the

WOODS

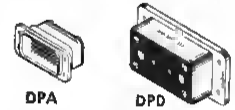
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above listed flying experience and were informed that Mr. Thorne kept no personal logs.

During the accident investigation it was learned from California public records that Mr. Thorne had been arrested 90 separate times for highway traffic violations and that 36 of them were for speeding. During a 12-year period he was involved in six reportable automobile accidents, one of which resulted in a fatality and another in personal injury.

For some period before 1951 he was placed on probation and in October of that year his driving privileges were revoked by court action. As a result of this action his Nevada driver's license was also revoked.

Evidence indicated he thereafter obtained Arizona and Michigan driver's licenses and drove an automobile in California and Nevada on at least one known occasion.

Pilot Under CAA Fire

At the time of the accident the CAA was in the process of filing a violation report against Mr. Thorne for flying without an instrument rating under conditions and circumstances requiring one.

The first incident on which the violation was based occurred October 10, 1955, when Pilot Thorne was flying N 25C from Fullerton Airport, Fullerton, California, to the Orange County Airport, California. During the flight he climbed without clearance through the overcast and upon reaching the Long Beach area, and still flying above the overcast, decided to land at the Long Beach Airport. He was given an instrument procedure clearance to descend, however, then exhibited extreme difficulty in understanding it.

The Long Beach controller explained the procedure to him in exacting detail but he still showed extreme difficulty in carrying it out. Because of this, traffic in the area was delayed 45 minutes.

While the October 10 incident was under further investigation a second series of complaints against Mr. Thorne was submitted to the CAA. It was learned that on October 7 and 8, 1955, Mr. Thorne took off from the Fullerton Airport without clearance when the visibility was one mile.

"§ 60.12 CARELESS OR RECKLESS OPERATION.

No person shall operate an aircraft in a careless or reckless manner so as to endanger the life or property of others.

§ 60.31 VISIBILITY.

(b) FLIGHT VISIBILITY WITHIN CONTROL ZONES.

When the flight visibility is less than 3 miles, no person shall operate an aircraft in flight within a control zone unless an air traffic clearance is obtained from air traffic control.

(c) FLIGHT VISIBILITY WITHIN CONTROL AREAS.

When the flight visibility is less than 3 miles, no person shall operate an aircraft within a control area.

NOTE: When the flight visibility is less than 3 miles, operations within control areas are to be conducted in accordance with instrument flight rules. Flight below 700 feet above the surface is not within a control area.

§ 43.61 INSTRUMENT FLIGHT LIMITATIONS. A pilot shall not pilot aircraft under instrument flight rules unless he holds a valid instrument rating issued by the Administrator."

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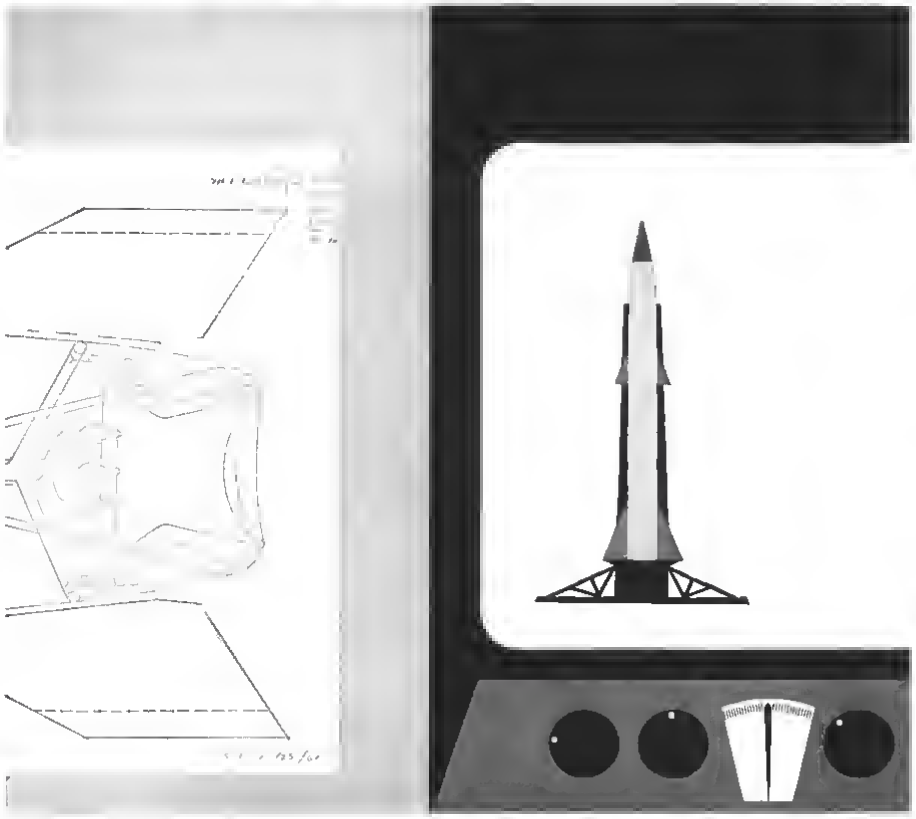
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or less and climbed through an overcast to above the clouds. This information was obtained while Fullerton officials were investigating the source of several extremely low flights (buzzing) over the city by an aircraft without lights.

The latter investigation revealed these incidents occurred when only Thorne had taken off from the airport. An official of the airport testified that Mr. Thorne had previously been reprimanded for unreasonably fast taxiing and as a result of the "buzzing" had been requested to base his aircraft elsewhere. It was while moving his aircraft to Orange County that the October 10 incident took place.

On October 11 Mr. Thorne voluntarily came to the CAA offices at Long Beach and readily admitted the incidents. At this time he stated that he held no instrument rating but showed he was familiar with the regulations applicable to the aforementioned flights. These requirements were further amplified during the conversation.

He was also advised at this time to terminate such instrument flights until he demonstrated capability and was certificated for them. He was told to take immediate steps to this end. Mr. Thorne was further advised that violation charges would be processed and filed against him for the aforementioned incidents.

During the conversation Mr. Thorne impressed the CAA Safety Agent as primarily concerned with the loss of his flying privileges which he used regularly when traveling between Las Vegas, his residence, and Los Angeles. The violation report was prepared and on October 17 it was forwarded for action.

Fully Instrumented

Mr. Thorne purchased N 5825C on June 10, 1955. The aircraft was fully equipped at this time with instrumentation and appliances for instrument flight. This included a full instrument panel, ILS (Instrument Landing System) equipment, Lear L-2 autopilot with approach coupler, Lear ADF-12, several radio transmitters and receivers, both low frequency and VHF (Very High Frequency). The aircraft generator supplying electrical power was a Delco-Remy 50 ampere, model 1101588. The aircraft was also fully equipped for night flying.

Because of the complete destruction of the aircraft few instruments were available for examination and it was impossible to determine if the autopilot was being used before the accident. Several settings of the navigational equipment were determined but none were significant as factors to the accident.

The aircraft logs found among Mr. Thorne's property at his residence showed the attitude and directional gyros of the aircraft were vacuum driven. The aircraft had been completely inspected at the time of sale and was considered to be in near perfect condition.

'Very Rusty'

While the purchase was being considered Mr. Thorne was given a demonstration flight and following consummation of the sale the seller suggested he take instruction before operating the aircraft. Pursuant to the suggestion Mr. Thorne

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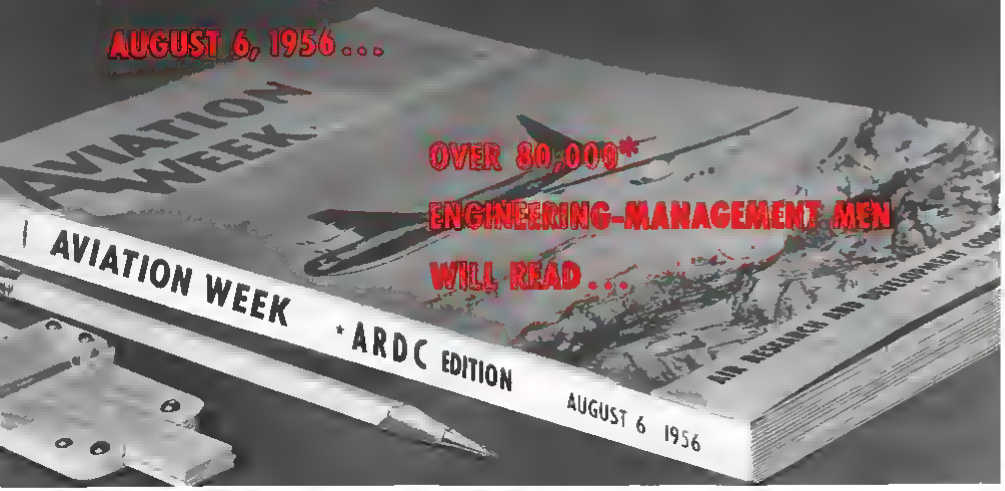
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SAFETY

flew with an instructor for about two hours

During this time he assisted the instruction be confined to takeoff and landing practice. After the flight the instructor told Mr. Thorne he was not considered checked out, however, Mr. Thorne stated he could fly the aircraft and took no further instruction.

The instructor testified during the public hearing that Mr. Thorne's flying was "very rusty" and showed little evidence that he had accumulated 3,000 hours or that 800 hours were instrument.

Several other witnesses who had flown with Mr. Thorne also testified during the public inquiry. Most stated that he was familiar with the aircraft instrumentation and knew how to use it. They stated he seemed careful and conservative while flying.

One witness who had flown considerably with him, and who had some piloting experience stated that she had been with him when he climbed through the overcast on several occasions and he did not use the aircraft's autopilot. She stated he was in the habit of climbing and descending while controlling the aircraft manually. She added however, that he did use the autopilot during en route flight and was fully acquainted with its use and operation.

Non-Standard Fuel Tank

During the investigation it was learned that a 52 gallon non-standard auxiliary fuel tank was installed in the aircraft baggage compartment. The modification work and necessary weight and balance computation were complete and the data was submitted to the CAA for approval. The ACA 337 (Major Repair and Alteration Report) form accompanying this data was dated October 6, 1955.

Final approval for this installation had not been given and the aircraft should not have been operated pending such approval. Mr. Thorne, however continued to fly it contrary to Civil Air Regulations governing such alteration.

The day of the accident Mr. Thorne arrived at the airport during the early morning hours and at 0444 departed in N 25C intending to fly to Las Vegas. At 0452 he returned to the airport and landed. He called the CAA communicator and canceled his flight plan commenting that he returned because the navigation lights, Grimes lights and radio had failed in flight.

He further stated that the Grimes lights had been installed Saturday (October 15) and he suspected an electrical problem from the installation which incorporated the lights that failed in a common circuit.

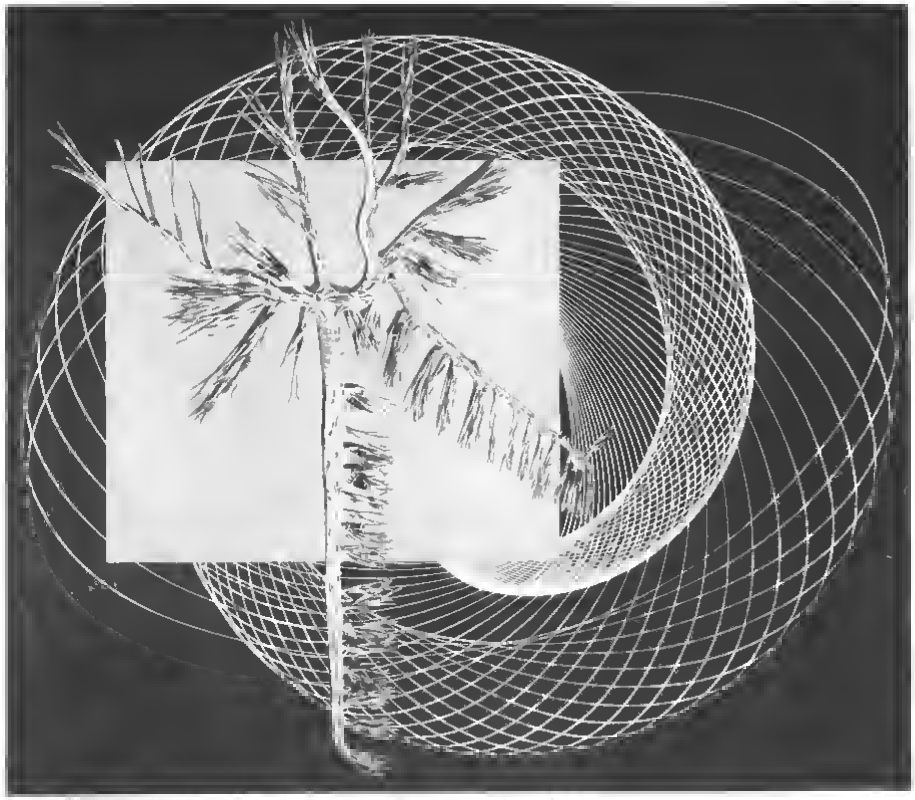
Anti-Collision Lights Installation

During the day Mr. Thorne told Pacific Airmotive Corporation employes that he was dissatisfied with the installation and wanted the Grimes lights repositioned farther forward on his aircraft. He insisted that one be mounted above and just behind the pilot seat on the top of the fuselage. The other was installed on the bottom of the aircraft slightly farther rearward than the top light.

With the one on top mounted upward and the other inverted the resultant rotating







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ing flashes moved in opposite directions. Both lights were controlled by separate switches and could be turned off or on independent of each other and any other lights on the aircraft.

The lights were functionally tested and operated normally. Employes of the repair agency stated that because the aircraft logs were not in the aircraft a new computation of the aircraft center of gravity was not made nor was a Major Repair and Alteration Report, form 337, completed. Also no electrical analysis was made following the light installation and no flight test was performed to determine how the lights functioned in flight or if any reflection or glare resulted during their operation.

While the relocation work was performed it was determined that the prior failure of the navigation and Grimes lights had occurred because an inadequate circuit breaker was installed during the original installation on that circuit. The radio trouble was repaired by replacing a burned out tube.

Lights Caused Vertigo

During the accident investigation flight tests were conducted to determine what, if any, effect the Grimes rotating lights had on a pilot while flying in the overcast. These tests were considered especially important because Mr. Thorne apparently lost control of his aircraft while flying in the overcast.

Using a Beech Bonanza with nearly identically mounted lights, the tests were flown by a qualified instrument pilot and observed by a Board investigator. The suspicions of the accident investigators were borne out during these tests and it was learned that an immediate and seriously distracting effect was caused by the lights. It was learned that the opposite rotation and brilliance of the forward mounted lights caused the clouds to appear to move in, out, up and down when the flashes struck the aircraft wings and propeller, reflecting into and around the cockpit.

The pilot was immediately confronted with serious vertigo* which required the highest degree of skill and concentration to maintain instrument control of the aircraft while being affected by the distracting conditions. From the tests it was concluded that lights installed and operating in this manner could cause distraction and vertigo of a disastrous effect on pilots with limited experience.†

Through investigation and testimony of witnesses it was learned that Mr. Thorne slept from 2230 on Saturday, October 15, until 1200 the next day. On Sunday he

*Pilot vertigo as appropriately defined in a recent Flight Safety Foundation Bulletin states: Webster defines vertigo as dizziness or swimming of the head. In aeronautical circles the word usually means a loss of the sense of the true vertical as well as a turning sensation. Furthermore, vertigo doesn't mean merely that one does not know which way is up; one feels strongly that same wrong direction is the proper one. The feeling isn't vague. It is almost overpowering. Vertigo is apparently affected by vision as well as the other cues to balance."

†As a result of the Board's investigation of this accident the Aircraft Owners and Pilots Association and the Beech Aircraft Corporation issued bulletins to pilots describing the effects of flicker vertigo from using these lights in an overcast. Beech advises: Turn off your rotary beacons before entering an overcast.

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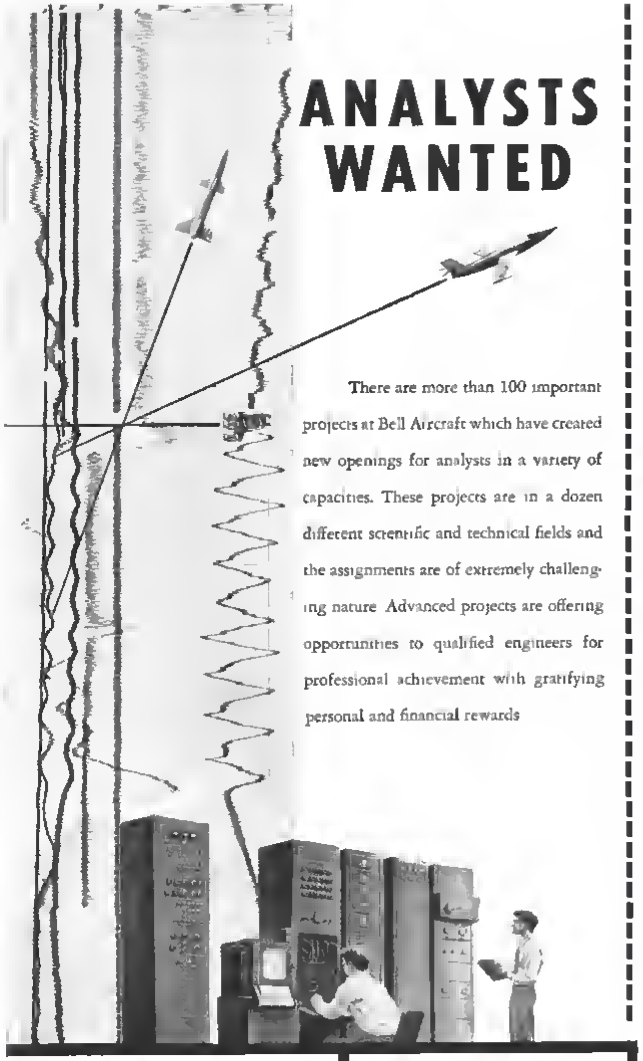
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SAFETY

skipt from 1800 until 2300 after which he attended a party celebrating his 41st birthday. Following this he was driven to the airport. He received little sleep on Monday and spent the day overseeing the flight relocation. Many persons said Mr. Thorne appeared tired throughout the day and evening before the flight which resulted in the accident.

Dissatisfaction With Rules

Officials from the CAA Office in the region where the accident occurred testified during the public hearing and expressed dissatisfaction with the Civil Air Regulations governing flights within a control zone.

They pointed out there was no clear delineation in the rules that distinguished IFR and VFR flight conditions. They stated there is misunderstanding regarding the nature of a traffic clearance wherein some pilots believe that a clearance to 'take off from' or 'enter' a control zone automatically released the pilot from adherence to pertinent regulations relating to pilot qualification or certification.

Many pilots further believed such clearance on a VFR flight plan also permitted a climb through an overcast or other flight when control of the aircraft was possible only by reference to flight instruments.

The witnesses emphasized that among highly qualified aviation personnel the intent of the existing regulations to prohibit such abuse was understandable. However, for enforcement purposes a responsibility of the CAA the rules were ambiguous and lacked sufficient specificity to provide that intent with adequate enforceability.[5]

Following the accident in the interest of corrective action greater supervision and safety CAA operations personnel of the region require a pilot filing a flight plan to indicate whether or not he holds an instrument rating.

This information will be furnished the tower controllers interested in the flight and if conditions of weather are less than 1,000 feet ceiling and/or less than one mile visibility the pilot on a VFR clearance will be advised to postpone the flight or file the flight plan according to instrument rules.

Further aircraft arriving in the control zone under a VFR flight plan in the stated conditions will be reported to enforcement officials for investigation.

ANALYSIS

As indicated the Thorne aircraft was observed to take off in a normal manner and to begin a right climbing turn in apparent conformity to the departure clearance. Thereafter it established the climb out heading and disappeared from view in the overcast. Several qualified witnesses stated that during this time the engine seemed to be operating normally and the

[5] As a result of the extent of the misunderstanding that seems to exist among pilots and the position the CAA has taken with respect to the enforceability of the regulations the Board has initiated action looking toward the amendment of Sections 60.30 60.31 and 43.65.

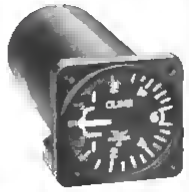
Such amendments would be designed to state specifically those minimum weather conditions below which VFR flight could not be conducted within a control zone even though a traffic clearance were obtained.

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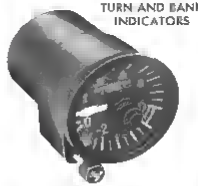
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aircraft was fully lighted including the rotating beacons.

Shortly thereafter however the engine and propeller sound increased in a manner which indicated to the observer that the Bonanza was turning left and descending rapidly. This was confirmed when N 25C suddenly emerged below the overcast in a tight left spiral.

Loss of Control

This series of events and the manner in which they occurred strongly indicate that Mr. Thorne lost control of the aircraft and a characteristic descending spiral resulted.

It is also believed that the loss of control probably was induced by vertigo and the pilot followed his sensory indications in controlling the aircraft attitude rather than indications from the appropriate flight instruments.

This opinion is supported by the general problems of instrument flight and by other accidents or near accidents which occurred in the same manner for this reason. It is believed that following the initial spiral Mr. Thorne was unable to recover full control of the aircraft and continued to reenter and dive out of the overcast. He was apparently flying alternately under visual conditions immediately thereafter confronted by instrument conditions and was never able to regain complete control of the aircraft.

During this time he flew several circular patterns obviously influenced by desperation and panic and possibly attempting to return to the airport or avoid high terrain on all sides except the west. It appears that he then tried to climb through the overcast again but before reaching the clear area above it entered another steep descending spiral. An abrupt turning pull up from this spiral caused structural failure.

Design Limitations Exceeded

An aircraft like any other mechanical piece of equipment can be expected to fail if its design limitations are exceeded. In this case as indicated previously the investigation did in fact establish that the design limitations of N 25C had been exceeded in the abrupt pullup following the final dive and that no mitigating structural design deficiencies were involved in the failure.

While the excessive loads were undoubtedly imposed inadvertently or as a final desperate move to arrest the dive this fact cannot be considered as a reflection on the aircraft design.

While such factors as cleanness of design comparatively light stick forces turbulent air etc undoubtedly do contribute to the ease with which control is lost there is no substitute for proper instrument training and proficiency for a safe and sound operation of aircraft in overcast weather conditions.

Based on all the known conditions and circumstances the Board is of the opinion that the initial vertigo was the result of several adverse factors personal in nature to Mr. Thorne and circumstantial to the situation.

The first of these factors is believed to have been his general disregard and disrespect for safe instrument flying practices

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"What's a Silicone?" is the title of a 32-page booklet which answers that often asked question in semi-technical terms. Indexed and illustrated, the booklet has earned an international reputation as the most interesting and informative description of silicones ever published. *No. 81*

"Silicone Glass Parts by Vacuum Tumbling" a reprint from MATERIALS AND METHODS, gives detailed procedure for making short runs of oversize complex or experimental parts without the expense of production mold. Is supplemented with several illustrative photos. *No. 82*

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With properties that overcome the limitations of both conventional organic finishes and vitreous enamels, silicone-based paints are helping designers engineer longer-lasting beauty and service into a broad range of products. One of the most recent examples is the finishing of housetrailer bathtubs by Sherer-Gillett Co. of Marshall, Mich.

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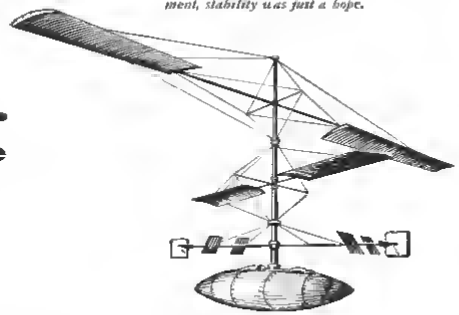
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nd procedures. It appears that Mr. Thorne was quite willing to climb through the overcast without clearance, proper certification, or regard for other possible traffic.

Although violation charges were filed against him and he has recently reprimanded for these practices he again without the required certification knowingly attempted to conduct another flight through the overcast. Although the Board is reluctant to associate the pilot's driving record with his flying habits ample evidence leads to the opinion that they were similar.

The fact that Pilot Thorne did not hold an instrument rating does not necessarily mean that he was incapable of instrument flight, however the Board feels that it may indicate he was unsure of his ability and proficiency to the extent that he was unwilling to attempt to qualify for the rating.

The second factor is considered circumstantial and is believed to have been partially responsible for the apparent vertigo. This factor was the effect produced by the forward mounted rotating beacons. During flight tests the opposite rotating flashes and the attendant reflections were capable of inducing serious and immediate vertigo on a qualified instrument pilot.

The Board is therefore of the opinion that it probably affected Mr. Thorne in a like manner. Considering his fatigued condition it is believed he was even more susceptible to vertigo, and it is believed the fatigue would also delay corrective action during the initial loss of control and thereafter while attempting to regain it.

Repair Agency Criticized

The Board feels that there was little justification for the repair agency having installed an inadequate circuit breaker in the initial installation or for having undertaken the installation or relocation of the lights without determining that Mr. Thorne had the necessary aircraft records for them to complete the work and properly return the aircraft to service.

Although maintenance personnel were reluctant to relocate the lights because of the suspected glare and reflection the work was done despite this concern.

Lacking the necessary completion of the ACA 337 form the aircraft was being flown with an unapproved installation.

Further the added electrical load of the rotating beacons and the existing electrical loads of the aircraft equipment good practice would have necessitated an electrical analysis. Consisting all factors Mr. Thorne was operating the aircraft contrary to Civil Air Regulations pertaining to such installations.

The Board has considered the possible use of the autopilot during the departure and the possibility of it failing as a factor in the accident. However complete destruction of the components necessary to determine this possibility precluded the Board's ability to make such a determination.

Considering the testimony as to the habit of Mr. Thorne to control his aircraft manually during climb out there is no reason to believe he did not do it this way on the subject flight. Also considering that the attitude and directional gyros were vacuum driven the aircraft could have been

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manually operated if the autopilot was not working provided there was adequate cockpit lighting to see the instruments

The continued operation of the navigation lights throughout the flight indicates that there was available electrical power for cockpit lighting

FINDINGS

On the basis of all available evidence the Board finds that

1 Joel W Thorne held a valid commercial pilot certificate and medical certificate but did not hold an instrument rating

2 Violation charges were pending against him for entering the overcast without clearance and without an instrument rating

3 Mr Thorne was fully aware of the charges and that his flights were contrary to safe practice and the intent of Civil Air Regulations

4 Despite this knowledge he knowingly attempted another flight through the overcast October 17

5 The takeoff and climb out appeared normal until the aircraft entered the overcast

6 After entering the overcast control was lost and the aircraft began a left descending spiral

7 Several circular patterns were flown during which the flight climbed into and emerged below the overcast several times in a manner indicating partial control accompanied by panic and desperation on the part of the pilot

8 Without regaining full control the pilot reentered the overcast at a steep angle but failed to reach the clear area on top before entering another descending spiral

9 During the attempted recovery the aircraft was subjected to forces beyond its design structural strength

10 The installation and relocation of the pitching beacons were not in accordance with required procedures

11 Flight tests with similarly located lights indicated immediate and serious pilot vertigo which was an element contributing to the initial loss of control in the subject accident

12 There was no evidence found to indicate malfunction or failure of the aircraft structure or controls prior to the load induced failure

13 Ascertainment of the possibility of electrical failure or determination of electrical equipment being used through physical evidence was precluded by a complete destruction of that equipment

PROBABLE CAUSE

The Board determines that the probable cause of this accident was the pilot's loss of control during which the design strength of the aircraft was exceeded causing structural failure Vertigo and the pilot's inability to take corrective action were contributing factors

By the Civil Aeronautics Board:

Ross Rizley
Joseph P Adams
Chan Gurney
Harmar D Denny

SUPPLEMENTAL DATA

The Civil Aeronautics Administration was notified of this accident and an investigation was conducted in accordance with Public Notice " effective January 1, 1954 as amended April 1, 1954 which delegated the Board responsibility to investigate aircraft accidents involving aircraft weighing 12 500 pounds or less

On November 10 1955 the Board terminated the delegation of responsibility for the investigation of this accident to the CAA and directed that an investigation be made by the Board in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938 as amended

An investigation was immediately initiated and a public hearing was held by the Board in Hollywood California, on December 19 20, 1955.

The Aircraft

N 5825C Beech model C 35 was manufactured in 1951 with serial number D-2777 It was resold several times before being purchased by Mr Thorne June 10 1955 An annual inspection was completed before this date at which time the total aircraft time was 1 106 hours There were no log book entries after the inspection and the accumulated aircraft time since then is unknown

The powerplant Continental model E-225 8 was installed July 10 1953 with zero hours and had accumulated 304 hours on June 10 1955 The propeller Beech model 215 109 was original installation and had accumulated 800 hours on July 10, 1953 It was overhauled before being installed on the new engine July 10, 1953.



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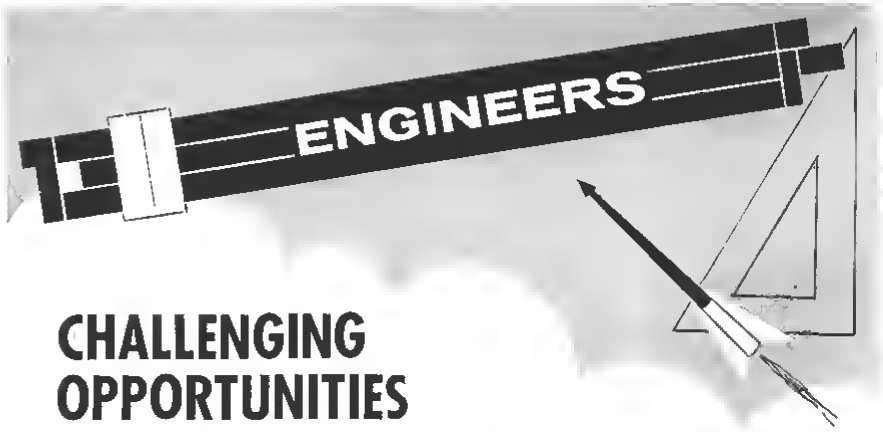
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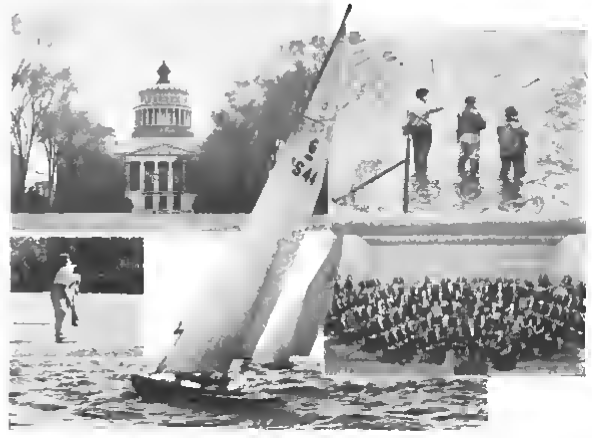
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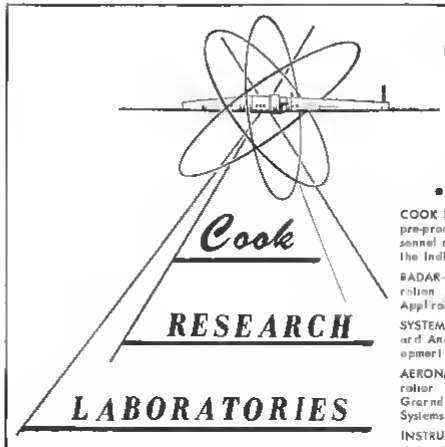
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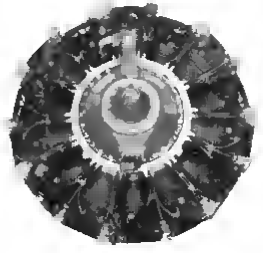
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Serial: A-545

AIRFRAME—3130 hours. 1000 hour inspection completed 60 hours ago. Wings were 25" tanks pulled bolts magnafluxed landing gear 50" str.

ENGINES—Pratt & Whitney AN 14B left—696 hours right—483 hours Sparton manifolds.

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52 hrs total time

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1 engine.
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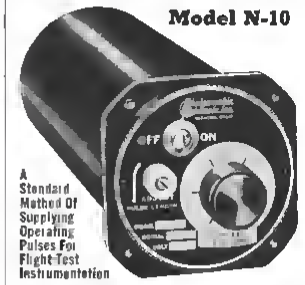
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LETTERS

British Reaction

Your editorial comments on the Speed Record in AVIATION WEEK for March 26 (p. 21) leave me with a somewhat chilled feeling of sadness. I have always tried to nurture the belief that we—the United States and the U.K.—are good friends but certainly your comments discourage this belief. They are neither friendly nor courteous.

It should have thought that it was unnecessary for AVIATION WEEK to denigrate the achievements of "lagging British aviation" in order to bolster up the American picture and for an enlightened aviation publication to liken the performance of the Bell X1A, which is to be carried to 30,000 ft. and has a duration of 4 minutes, with the FD 2 is so puerile as to be unworthy of further comment.

The fact remains that the FD 2 was timed under FAI rules and regulations to exceed the speed of the F 100A by some 30 per cent. If an American aeroplane goes out and beats this figure under similar conditions, we, the British will be the first to congratulate you. At the time of writing and subject to official FAI confirmation, we hold the official speed record. We were also the first to exceed 1 000 m.p.h. under FAI observation and scrutiny.

It is merely the pompous bleat of a petted and spoilt child to cry "It's mine" regardless of whether it is or not. The achievements of American aviation do not need such a display of bad manners to impress the world.

LEONARD BRIDGMAN
Jane's All The World's Aircraft
52, Berkeley Square
London, W. 1.

(The following reaction is from the April 13 issue of The Aeroplane.—Ed.)

For many years the name "Aviation" has been carried by a well-esteemed American aeronautical publication. More recently in fact, only since the end of the war the name has been changed to AVIATION WEEK to signify the promotion of the magazine from monthly to weekly publication.

It was therefore with surprise that old friends of this magazine read the grudging remarks in its issue of March 26 under the heading of "Bring Back the World Speed Record Now." It will surprise the hard-driving team of engineering enthusiasts who worked with such a will on the Fairey FD 2 to be told that credit for their achievement should be given to the sins of omission of U.S. Defence Secretary Charles E. Wilson and his somnolent public relations aides.

The article then states unequivocally that the United States has at least three fighting aircraft designed for operational service that can outrun the Fairey research plane. These are, so AVIATION WEEK avers, the Vought Crusader, the McDonnell Voodoo F-101 and the Lockheed F 104 which has a capability in the 1,200 mph. range. All are fighting airplanes, the article explains, armed with cannons, rockets and missiles.

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

So far as research is concerned, readers are told in this field the Bell X1A hit Mach 2.5 (1,650 m.p.h.) more than two years ago.

Well? Well? So far as the military machines are concerned it will be interesting to see when they do achieve the speeds claimed for them and that within the exacting conditions set down by the FAI exactly how many cannons, rockets and missiles they do carry. When the Germans set up a World Record with a "standard" fighter before the War they lowered the top of the cockpit.

The differences which the article omitted to mention between the remarkable performance of the Bell X1A and of the Fairey FD 2 is, it seems necessary to remind people, that the delta took off under its own power (a Rolls-Royce Avon turbojet) from an aerodrome and flew for some 25 minutes, the Bell was hoisted to a great height and then dropped from its mother ship attaining its tremendous speed from a seconds-long burst of rocket power.

In these circumstances it does seem a pity to suggest that the World Speed Record rightfully belongs to the United States. If words mean anything, the rightful holder of a record is the person, body or country who or which establishes a record according to the conditions laid down. For this reason we have no doubt at all that the FAI will confirm officially the record established by Peter Twiss on March 10. Equally, we have no doubt at all that when an American airplane surpasses the speed of 1,132 m.p.h. according to the rules laid down for international competition the FAI will confirm the performance. And then, and not till then, will the record rightfully belong to our friendly competitors across the Atlantic.

THE AEROPLANE
April 13, 1956
"Rightly Is as Rightly Does"

TR . . . and No-Shows

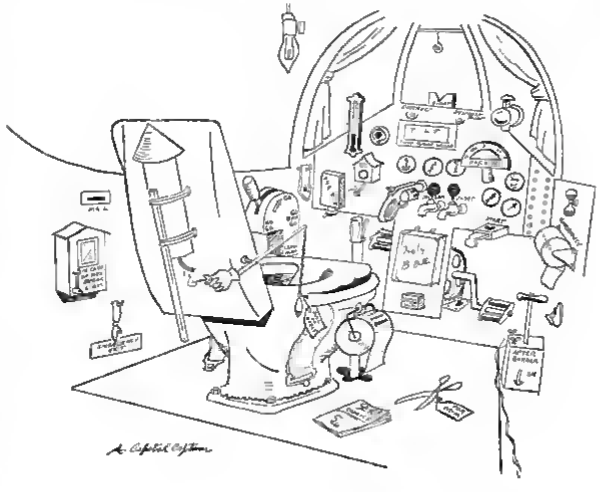
I refer to your lead editorial in your issue of April 2 with reference to the no-show problem.

While we continue to stew and mutter about this difficulty, there is an industry (the name of which we are reluctant to mention in terms implying any sort of approval) that licked this difficulty years ago. They do it by issuing two tickets, one for the transportation per se, and one for the space that is to be occupied. If you miss your TR . . . you can get your money back on your transportation, but your seat or berth is gone forever.

The airlines could follow a similar procedure, especially since so many of them are now following Pan American's lead in assigning seats at point of origin.

NAME WITHHELD

Pilot Fears Jet Cockpit Complexity

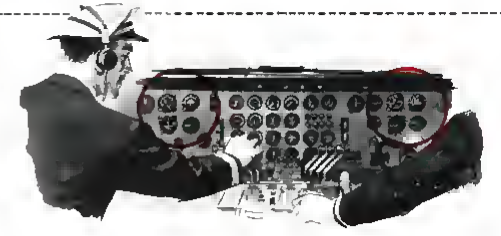


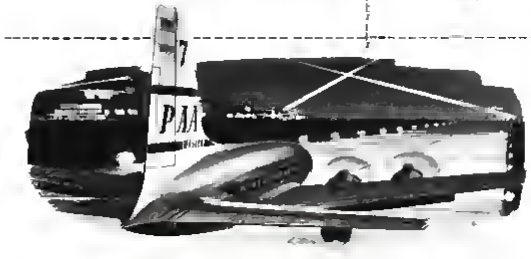
Aboard PAN AM's New Douglas DC-7Cs

3 SPERRY AIDS TO FLIGHT EFFICIENCY

Pan American has ordered the latest in Sperry flight aids for its luxurious new fleet of DC-7Cs . . . a continuation of its policy to give its passengers safe, smooth and comfortable flights regardless of weather . . . to help assure "on time" arrivals and departures. These Sperry instruments and controls supplement the skills of the crews and pay for themselves over and over again by assuring maximum flying efficiency.

Sperry Dual Integrated Instrument Systems will give Pan Am pilots more flight data in clearer visual form and in less space. This system consists of an extremely accurate primary direction instrument, a combined Zero Reader* flight director and gyro-horizon, and a pictorial deviation indicator.





Sperry Flight Control Systems will assure precise automatic control of aircraft on their intercontinental flights. Radio Beam Couplers fly the radio ranges automatically, and, in landings, the equipment responds to the localizer and glide slope beams for complete automatic approaches. Flight instruments above are combined in the systems for easy-to-read panel information.

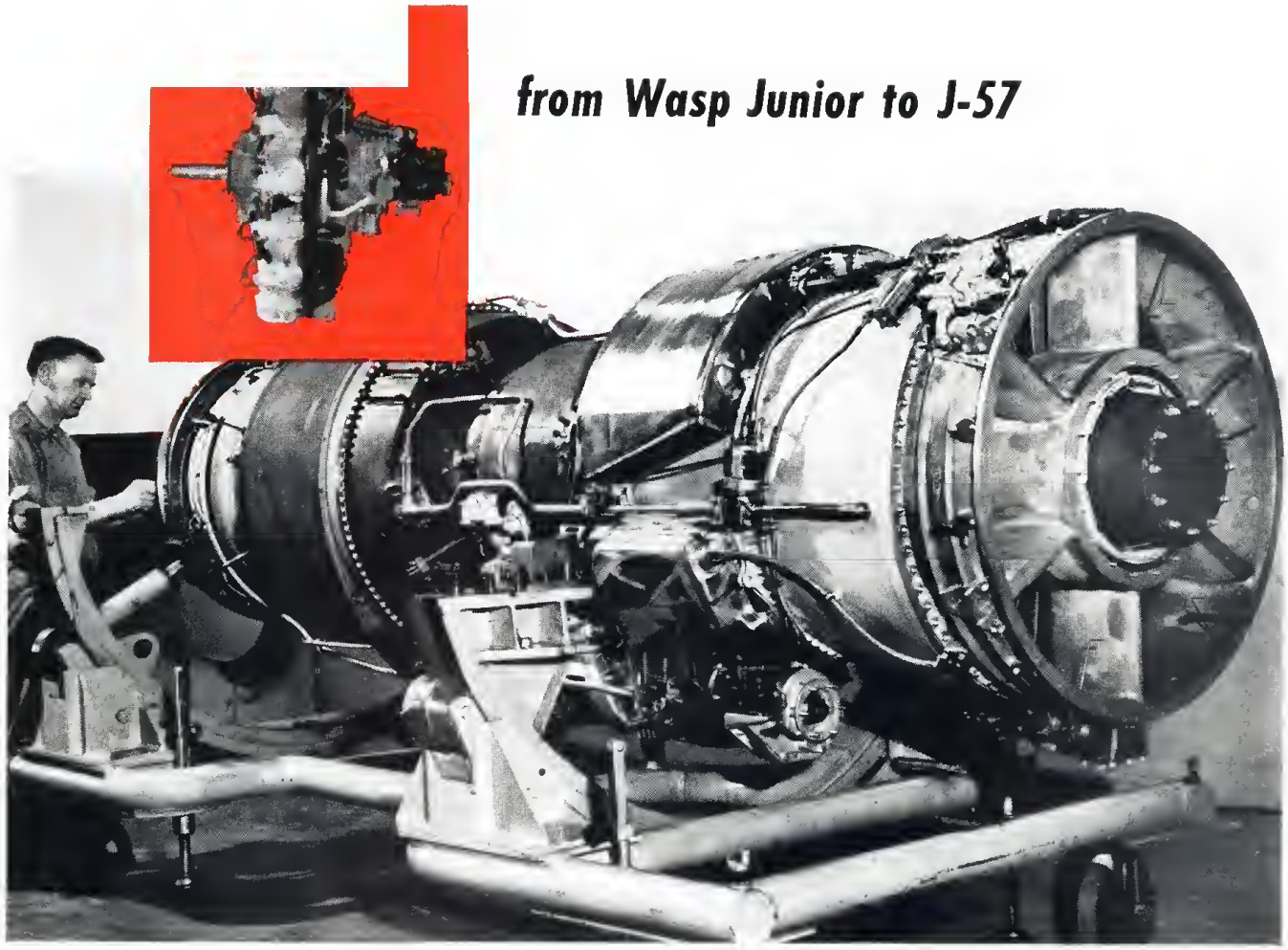
Sperry Engine Analyzers will enable quick pre-flight "tune-up" to assure smooth, maximum power. In the air, the equipment detects any ignition irregularity in the engine's performance which can be quickly corrected by adjustments or replacements immediately upon landing.

Our Aeronautical Equipment Division will be happy to supply further information on aids to flight efficiency.



*T.M.R. U.S. Pat. Of. Analyzer manufactured under John E. Lindsey Pat. No. 2618427

SPERRY GYROSCOPE COMPANY
Great Neck, New York
DIVISION OF SPERRY RAND CORPORATION

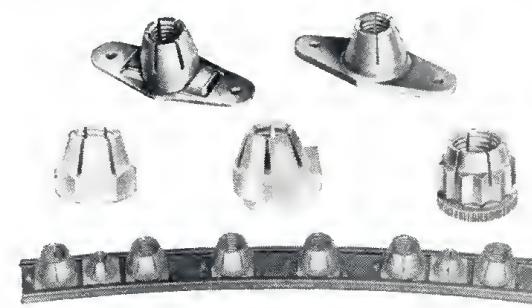


More than 25 years of engine development and the fasteners are still by ESNA

These two engines . . . built by Pratt & Whitney Aircraft over twenty-five years apart . . . dramatically reflect the evolution of aircraft power plants. Back in the early '30's engines rated at several hundred horsepower pulled air frames at speeds under 200 mph. Today the mighty J-57 develops over 10,000 pounds of thrust and rockets America's fighters through the skies at speeds faster than sound. Both of these power plants embody the finest design and high precision production skills of their era; and both engines use Elastic Stop® nuts for important fastenings.

During the past two and one half decades of power plant evolution, the greatest challenge presented to fastener manufacturers by the development of jet engines has been the increase in temperatures at which the fasteners must perform efficiently. ESNA offered the industry the first stainless steel, silver-plated, long-beam self-locking nut for performance at 1000°F. in 1947. And today ESNA is the first to produce a variety of locknut shapes manufactured from Type A286 stainless steel. These self-locking nuts will meet the full capabilities of currently produced A286 bolts at any temperature.

If you accept the practical value of more than two decades of this kind of field testing and of new development engineering to meet the needs of the industry . . . you'll rely on Elastic Stop nuts, too.



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